

# ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

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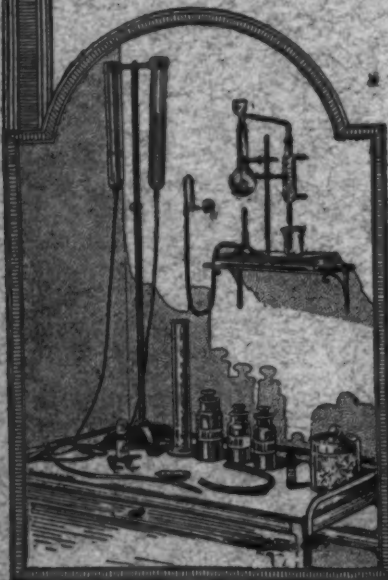
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## BONE GRAFTING: STUDY OF A SERIES OF CASES OPERATED IN U. S. ARMY HOSPITALS

BY JOHN B. WALKER, M.D.  
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THE following information relative to the present results of bone grafts and plates has been secured from a study of such records as are available in the office of the Surgeon General, U. S. A., and the Bureau of War Risk Insurance. Among 215,423 wounded in the A. E. F., there were about 25,000 fractures, and of these 15,165 were of the long bones; thus far there have been reported 906 cases (6 per cent.) of non-union; 611 of these cases were treated by bone grafts; 189 by Lane plates; 52 by suture with wire, and 54 were sutured with kangaroo tendon or chromic catgut.

The bones involved were:

	Grafts	Plates	Kangaroo Tendon	Wire
Humerus.....	118	19	13	14
Radius .....	161	5	4	8
Ulna .....	105	8	7	..
Radius and Ulna.....	54	11	3	3
Femur.....	46	87	12	10
Tibia.....	77	34	7	14
Fibula.....	9	..	..	..
Tibia and Fibula.....	41	25	6	5

Grafts from the various bones were taken from the tibia in 338 cases, and in 98 cases a sliding graft was employed. In 25 cases pegs made from boiled beef bone were used, and in 31 cases pieces of rib.

2. *Loss of substance* between the separated ends of the fragments in those cases where it was reported, varied from 3 to 12 cm., but averaged from 4 to 5 cm. Length of the graft averaged about 8 to 9 cm.

3. *Interval Between the Injury and Time of Operation.*—From these 611 cases in which grafts were used, partial reports have been received from 570 cases as follows:

The operation of grafting was performed within one hundred and fifty days upon 86 cases; between one hundred and fifty-one and two hundred days upon 104; between two hundred and one and two hundred and fifty days upon 85 cases; between two hundred and fifty-one and three hundred and fifty days upon 160 cases, and after three hundred and fifty-one days



upon 135 cases. The average time which elapsed between the injury and operation was as follows:

Humerus, two hundred and nineteen days; radius, two hundred and thirty-six days; ulna, two hundred and twenty-seven days; radius and ulna, two hundred and forty-six days; femur, one hundred and seventeen days; tibia, two hundred and thirty-two days; fibula, three hundred days; tibia and fibula, two hundred and thirty-five days; total, eighteen hundred and seventy-two; average, two hundred and thirty-four.

In a considerable number of cases there was some slight infection which did not materially interfere with the success of the grafting, showing the marked viability of well-made grafts. One report states that in 62 per cent. of 46 cases which suppurred after operation, the graft was successful. In 95 cases the infection was extensive enough to require the removal of the necrosed graft. In some cases in which there was doubt regarding the completeness of the healing, the two-step operation was performed, preliminary excision of the scar tissue, with replacement by a healthy skin flap, and followed after a period of ten days by the final grafting.

4. *Fracture of the Graft.*—As this occurred in a considerable number of cases, precaution should be taken to carefully apply a well-fitting, plaster-of-Paris, circular case to firmly immobilize the limb. This should not be disturbed for from eight to ten weeks. Furthermore, a supporting apparatus should be worn for several weeks longer, especially for the lower extremity.

5. *Results of Treatment.*—In order to compare the results of treatment, the date is taken on which the patients applied for an examination to determine the extent of their disability and the amount of their compensation—at the Bureau of War Risk Insurance. The above date is here called the rating date. The duration of treatment between the date of injury and the rating date in fractures which were grafted was for the humerus, five hundred and nineteen days; radius, five hundred and thirty-one days; ulna, five hundred and twenty-nine days; radius and ulna, five hundred and twenty-five days; femur, four hundred and seventy-seven days; tibia, five hundred and forty-three days; fibula, five hundred and seventy-two days; tibia and fibula, four hundred and eighty-three days. In 48 per cent. of the rated cases the disability was 25 per cent. or under. In 22 per cent. of the rated cases the disability was between 25 and 35 per cent. In 22 per cent. of the rated cases the disability was between 35 and 50 per cent. And in 8 per cent. of the rated cases the disability was over 51 per cent.

The next important question is to determine the date for the grafting operation which will produce the most favorable results. The above statistics indicate that in those cases in which an interval of less than two hundred days elapsed between injury and operation a low disability of 25 per cent. was secured in 43 per cent. of the cases. Whereas in those

## BONE GRAFTING

cases which were operated upon after an interval of two hundred days the same disability of 25 per cent. was obtained in 57 per cent. of the cases.

*Summary.*—In order to obtain the best results sufficient time must be allowed to elapse between the injury and the operation for the complete subsidence of the original infection, and the above figures show a more favorable recovery has followed the late rather than the early operation; that is to say, over rather than under two hundred days after injury. It is reasonably safe to operate during the fourth month after complete healing has occurred.

Grafts, autogenous, taken from the tibia have proved the most efficient material for bone grafting for fractures of the long bones, on account of its characteristic strength. They are best made with the saw and exact coaptation of parts of the graft to respective parts of the host bone must be secured.

While many of these records are as yet too incomplete to give the final end-results, yet sufficient evidence has been secured to prove that bone grafting is the most efficient method for non-union of fractures and very favorable results can be obtained in the largest percentage of cases.

# THE BACTERIOLOGY OF INFECTED WOUNDS WITH ESPECIAL REFERENCE TO THE IMPORTANCE OF STREPTOCOCCUS HÆMOLYTICUS

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THE data herein presented are based on an analysis of bacteriologic work done at Base Hospital 15, American Expeditionary Forces in France.

The enormous importance of the streptococcus hæmolyticus in all clinical surgery, as well as the similarity between war wounds and certain types of accidental injuries seen by civilian surgeons, justifies the publication of this study.

In order to avoid the drawing of false conclusions it is necessary to understand the conditions under which the work was done, and the technic used. During part of the time the hospital acted as a base hospital; but, during a large part of the period covered, its function was that of an evacuation hospital, the surgical cases remaining in the wards only a short time unless very seriously injured. Moreover, the limitation of the laboratory force, due to the general shortage of laboratory men in the American Expeditionary Forces and to sickness in our laboratory staff, made it necessary that the wound bacteriologist cover other fields of work not at all related to his own. The same cause prevented the completion of some of the records, and necessitated the development of quick methods, which, while fairly accurate, were manifestly lacking in scientific completeness. Again, the shortage of personnel made it impossible usually to make cultures at all stages in the evolution of the wound. Except in a few cases, only such wounds were cultured as were very seriously infected or were in so good condition that a secondary closure was contemplated.

The principles governing the work were: First, the furnishing of assistance to the clinician, and through him to the patient, by accurate, quick, intelligible reports. Second, the gathering of statistical data if, and where, possible. The former was distinctly felt to be the first duty.

An explanation of the technic used may be of interest to those having limited laboratory facilities at their command.

*Technic 1. Methods of Procuring Specimens.*—The wound exudates were collected by either the bacteriologist or the ward surgeon in one of two ways. The majority were collected on cotton-tipped applicators kept sterile in test-tubes. Other exudates were drawn from the depths of wounds into sterile capillary pipettes which were resealed at the bedside immediately after collection of the specimen. The latter method



## THE BACTERIOLOGY OF INFECTED WOUNDS

had advantages in securing the exudate from deep, profusely discharging wounds; but for general work the swabs appeared to be more practical.

Blood cultures from cases of suspected bacteraemia were made at the bedside by the bacteriologist, about 7 c.c. of the patient's blood being passed from a sterile syringe into about 200 c.c. of a 0.5 per cent. dextrose meat-infusion broth. No attempt was made to get anaërobic blood cultures from patients in the wards.

At autopsy, aërobic and sometimes anaërobic cultures were made from the heart's blood. About 1 c.c. of the blood was put into broth and about the same amount saved for anaërobic cultures. From the aërobic broth culture a subculture was made of blood-agar.

2. *Methods of Studying Specimens.*—From the exudates taken from wounds as above described, a direct smear was always made and a report of microscopic findings sent to the surgeon. The cultural results were reported as soon as possible.

For aërobic cultures our early technic involved the use of glucose broth, broth with meat, plain agar slants, and blood-agar plates. Later, the limited time and help, and necessary economy in the use of media led us to use only large blood-agar plates (15 cm. in diameter) for the culturing of aërobes from wounds. With that medium, a fairly accurate diagnosis of streptococcus hæmolyticus could be given in from five to twelve hours. Other aërobes were generally diagnosed from the same culture on the characters of colonies, and the morphology, motility and staining properties of the organisms. Broth cultures and slants of coagulated serum and plain agar were used for special cases. For example, *B. diphtheriæ* was demonstrated in the wound of a man who developed pharyngeal diphtheria after having been wounded.

For the rapid diagnosis of anaërobes, anaërobic broth and broth containing meat were soon discarded. The following routine technic was developed. A tube of litmus milk and a tube of 0.5 per cent. glucose agar were boiled from twenty to thirty minutes. The milk was cooled rapidly, inoculated, and covered with a layer of sterile albolin. The agar was inoculated when partly cooled or at the boiling point. Sometimes it was kept at a temperature of 100° C. for one-half to one minute or even five minutes after inoculation and then cooled quickly. The variations here noted in regard to the preparation of agar cultivations were determined by the microscopic findings in direct smears.

*B. Welchii* was diagnosed within twenty-four hours, principally by the morphology, lack of motility, and stormy fermentation of milk. The diagnosis of vibron septique was based upon delayed stormy fermentation of milk, morphology, motility, and the peculiarities of the colonies in the deep agar shake. A tentative diagnosis of spore-bearing anaërobes was attempted on the morphology and motility of the organism, and on the colony appearance and odor in the cultures. When time permitted, colonies were fished and studied in subcultures. In suspected

tetanus infection, agar cultures were boiled for five minutes after inoculation, and the organisms were also studied in anaërobic cultivations prepared according to Zinsser's method.

The use of only three cultures for routine examination of each wound was adopted, not as the best scientific procedure, but as a matter of expedience determined by the amount of time and assistance available, and by the necessity for economizing materials. It gave a fairly certain, very quick diagnosis of hæmolytic streptococcus, and of staphylococcus aureus and albus, differentiating at once between the hæmolytic and nonhæmolytic strains. It permitted a general, though not very accurate, identification of other aërobes. It gave a quick and fairly accurate diagnosis of *B. Welchii* and, with less certainty, of vibriion septique. It permitted the partial classification of some other anaërobes.

On the other hand, the differentiation of many of the aërobic bacteria was certainly very incomplete, while even the presence of some anaërobic types was probably often not revealed by these methods. Such, however, was the system which to us seemed the most reliable and practicable under the circumstances.

*Analysis of the Data Obtained.*—In my series there are 276 cases for which bacteriologic records are available. Of these, 73 or 26.45 per cent. were fatal, and 203 or 73.55 per cent. were nonfatal. In noting these figures it must be remembered that most of the cultural examinations were made from the more seriously wounded. From this series of 276 wound cases the information obtained was more or less complete.

Rather interesting results have been obtained from the consideration of the following points:

1. The character of the bacterial flora found in wounds after the lapse of various periods of time.
2. The symbiosis of organisms in wounds.
3. The prognosis of cases showing the presence of certain organisms.
4. Secondary suture of wounds.
5. Gas infection.
6. The bacterial infection to be most feared in cases of gunshot wound, *i.e.*, streptococcic bacteriæmia.

Other questions were approached but my figures thereon are neither large enough nor striking enough to permit the formulation of any conclusions. These latter figures were recorded simply with the idea that they might be of use in conjunction with other reports.

1. *The Character of the Bacterial Flora Found in Wounds After the Lapse of Various Periods of Time.* Chart I shows an analysis of 358 reported bacteria isolated in 207 cultures at various periods.

The streptococcus was not only fairly frequent in the early cultivations but was extremely persistent, its incidence after two to three months being practically the same as that during the first three days after reception of the wound. Table I shows an overwhelming pre-

## THE BACTERIOLOGY OF INFECTED WOUNDS

ponderance of the hæmolytic variety of streptococcus, and for that reason my charts and tables show all streptococci together without reference to their hæmolyzing powers.

TABLE I  
*Streptococcus.*

	From wounds		From the blood		Total	
Hæmolytic .....	76	95 per cent.	27	90 per cent.	103	93.64 per cent.
Nonhæmolytic .....	4	5 per cent.	3	10 per cent.	7	6.36 per cent.
	80	100 per cent.	30	100 per cent.	110	100 per cent.

As has been observed by others, an interesting fact to be noted in an analysis of Chart I is that the anaërobes, being very frequently present just after the infliction of wounds, become rapidly less and less frequent, later disappearing entirely. While anaërobes comprised 38.5 per cent. of the strains cultivated from wounds within the first three days after injury, the incidence of anaërobes in the cultivations made between five and eight days after wounding was only 7.3 per cent. Staphylococcus and other aërobic types as a whole were frequent, their relative frequency in infected wounds rising, of course, as the incidence of anaërobes declined. It was interesting to note that the average number of bacterial types found in the cultures, at whatever period taken, was slightly less than two.

2. *Symbiosis in Wounds.*—An attempt was made to determine what organisms will grow well together in wounds, and conversely, what associations of organisms are not likely to occur. It is seen that only six different organisms were concerned in all the ten most frequent associations. The most common association was that of the hæmolytic streptococcus with staphylococcus aureus. All the other frequent associations contained either streptococcus or staphylococcus. Another striking fact noted that staphylococcus aureus growing alone was found in many nonfatal wounds but in only one fatal wound. *B. Welchii* and other anaërobes were found as a rule to be in association with streptococcus or staphylococcus.

3. *The Outcome of Two Hundred and Twenty Cases Showing the Presence of Certain Organisms.*<sup>1</sup>

(a) *Streptococcus.*—Streptococcus without anaërobic association gave deaths at all periods during the first four months, especially during the second month. Moreover improvement<sup>2</sup> and cure were very tardy in those cases showing staphylococcus but without anaërobes. The asso-

<sup>1</sup> The remarks in this section are based on bacteriologic findings in wounds, hearts' bloods, and metastatic abscesses.

<sup>2</sup> Owing to the type of our hospital, many of the cases had to be evacuated when wounds were only partially healed. Such cases are here considered as "improved." Cases evacuated unimproved numbered only two, and are not here included.



ciation of streptococcus with staphylococcus but without anaërobes gave a somewhat worse prognosis, while, in the association of streptococcus with anaërobes the prognosis was even worse.

(b) *Staphylococcus Aureus*.—*Staphylococcus aureus* infections showed a much lower death rate than those due to streptococcus, and the few deaths due to staphylococcus occurred during the first month. Improvement and cure were more frequent and earlier than in the case of infections with a streptococcus. As has been noted, an infection with associated staphylococcus aureus and streptococcus was considerably more virulent than an infection with either alone. The association of *Staphylococcus aureus* with anaërobes raised somewhat the virulence of staphylococcus infection though still the deaths were all within the first month.

(c) *Anaërobic Infections*.—It would seem that the virulence of anaërobes was increased by association with streptococcus and decreased by staphylococcus association.

(d) *Aërobes as a Whole Excepting Streptococcus and Staphylococcus Aureus*.—Wounds which on bacteriologic examination revealed only members of this group pursued a favorable course. Improvements were early and numerous; the only death in this series of cases occurred early.

(e) For comparison with my figures on the influence of the presence of various organisms in wounds, I present Table II, compiled from a

TABLE II  
*Bacteriology and Outcome of Cases with Gas Infection—Series of Weinberg and Seguin.*

	Strept. without staph. without anaërobes.	Staph. without strept. without anaërobes	Strept. with staph. without anaërobes	Strept. with anaë- robes without staph.	Staph. with anaë- robes without strept.	Strept. with anaë- robes with staph.	Anaërobes without strept. without staph.	None of preceding organisms.	Total cases.
Fatal.....	..	..	..	10 22.7 per cent.	1 16.7 per cent.	1 14.3 per cent.	27 42.9 per cent.	..	39 31 per cent.
Nonfatal.....	1	1	2	34 77.3 per cent.	5 83.3 per cent.	6 85.7 per cent.	36 57.1 per cent.	2	87 69 per cent.
Total.....	1	1	2	44	6	7	63	2	126

series of Weinberg and Seguin.<sup>3</sup> This series is composed entirely of cases showing signs of gas infection, either gangrenous or phlegmonous. Though the element of elapsed time is lacking in the series, a good idea can be gained of the comparative virulence of the principal infections encountered. The figures, in a general way, support and supplement those from my similar cases.

<sup>3</sup>Weinberg, M., et Seguin, P.: *La Gangrene gazeuse*, Monographies de l'Institut Pasteur, 1917.

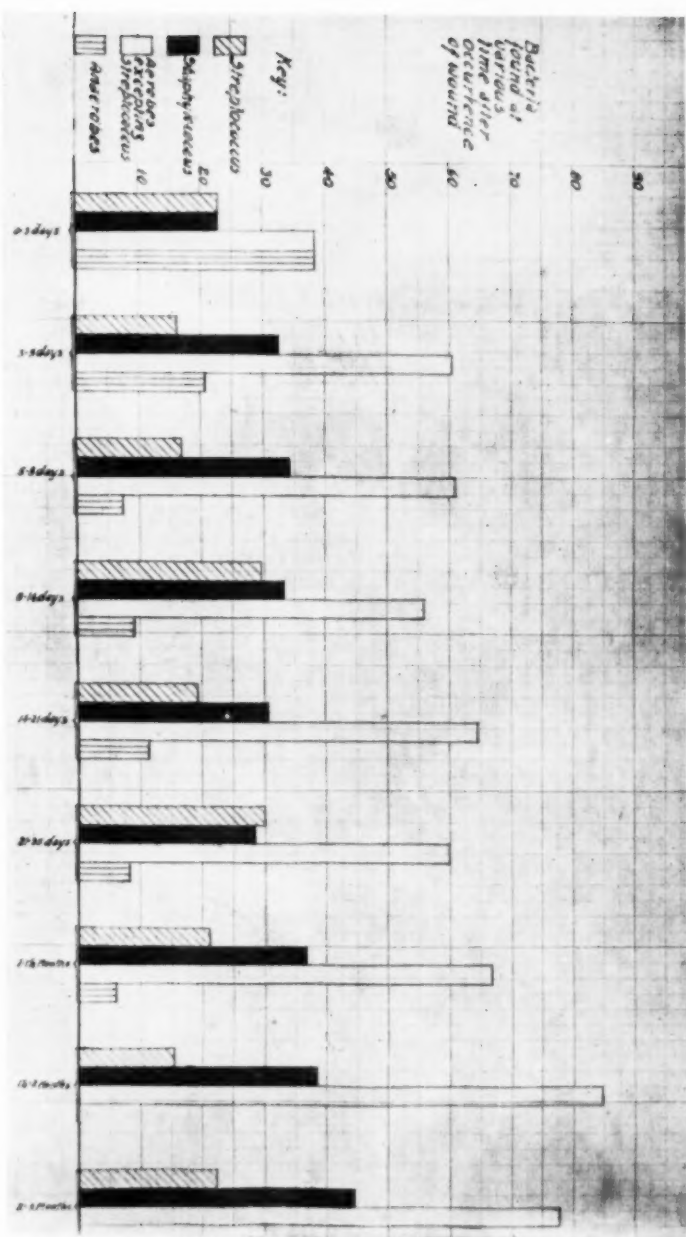


CHART I.—Bacteria found at various times after occurrence of wound. (All charts in this report based on percentage figures).

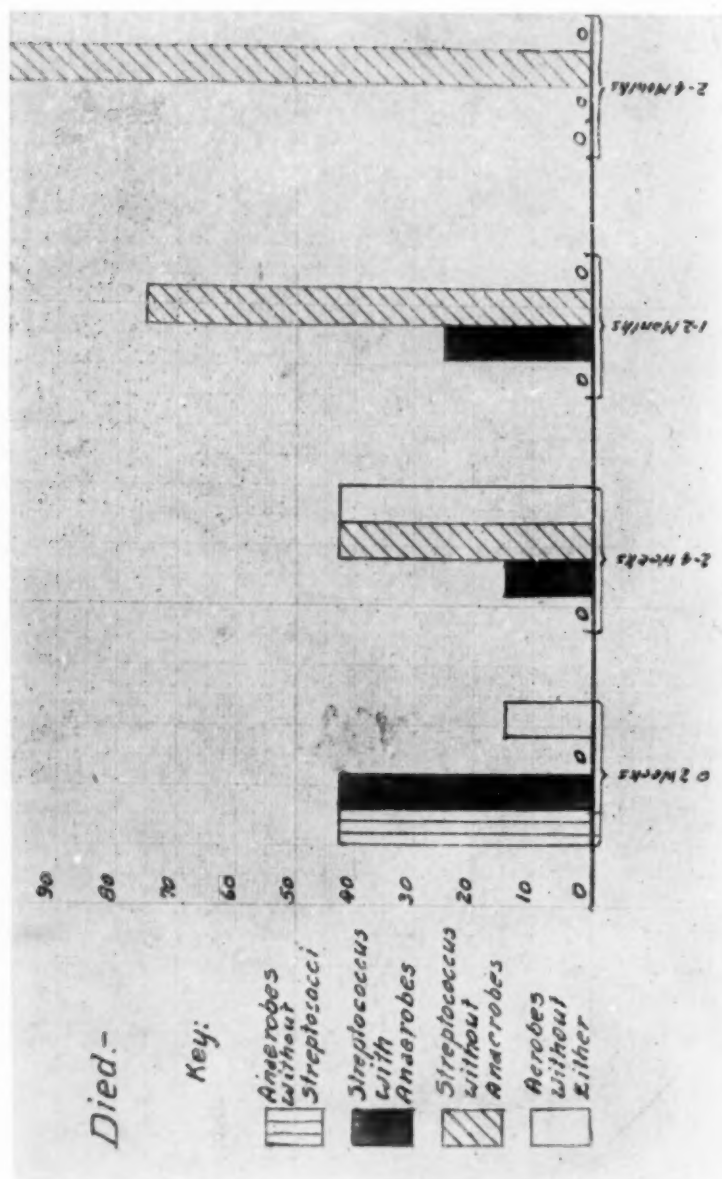


CHART II.—The prognosis of cases showing the presence of certain organisms.



## THE BACTERIOLOGY OF INFECTED WOUNDS

4. In the preceding section an attempt was made to establish the prognosis based on bacteriologic findings. Approaching the problem from the opposite direction: Given a certain clinical progress in the wounded patient, what organisms are we most likely to find? Taking for example Chart II, we find that, of all cases dying during the first two weeks, 85.8 per cent. showed anaërobes with or without streptococcus, none of them showing streptococcus without anaërobes. On the other hand, during the second month, fatal cases showed streptococcus without anaërobes in 75 per cent. and streptococcus with anaërobes in 25 per cent. Furthermore, all cases dying more than two months after injury showed streptococcus without anaërobes. Turning to improvements and cures, we found that those occurring early were usually infections by the aërobes aside from streptococcus, though some anaërobic infections came within that class. When improvement and cure occurred only at a late date we found usually infections by streptococcus unassociated with anaërobes or by streptococcus and *Staphylococcus aureus* unassociated with anaërobes.

*4b. Wound Closures Regarded Clinically and Bacteriologically.*—A secondary suture was performed in a large number of cases in this hospital without bacteriologic control, or in spite of an adverse bacteriologic report. Of the 55 cases with recorded secondary suture from which one or more bacterial cultures had been made, the result of the suture is unknown in seven. Three of the cases were only attempts at partial suture with drainage. Of the 45 remaining cases of complete secondary suture, 34, or 75.6 per cent., were successful; 5, or 11.1 per cent., were failures, and 6 or 13.3 per cent. were partial failures. Over 60 per cent. of the failures and partial failures were due to infection. Now, although the average time interval between the reception of the wound and the secondary closure was just over twenty-seven days, it is to be noted that in the case of the failures due to infection the average time interval was only fifteen days. Apparently these failures were due to too great haste. Of the cases with known interval between the reception of the wound and the first medical treatment, the average length of time was two and three-tenth days; this interval before first medical treatment was much longer in the cases of failure due to infection.

5. *Gas Infection.*—My series bearing on this subject was small, but gave several clear impressions. In the first place, it was noted that more than two-thirds of the cases having anaërobes in the wounds showed nevertheless no evidences of gas infection. In most cases the anaërobes were simply contaminating, not infecting agents. Again, it was noted that all our cases showing evidences of gas infection involved a lower limb, that a large percentage of these involved the thigh, and that the majority of them did not show any involvement of the bone. Thus it seems that the heavily muscled parts of the body, especially of

the lower limb, are the parts most apt to develop gas gangrene, and that the fracture of bone is not an essential factor.

6. *The Bacterial Infection to be Most Feared in Cases of Gunshot Wound, i.e., Streptococcus Bacteriæmia.*—Most of the figures found in Table III are so small as to be of little value unless combined with those of other series. There is, however, one striking conclusion to be drawn. Of the 72 fatal cases included in this series, a culture was made from the blood either before or at autopsy in 46. That culture showed a growth in 37, or 80.4 per cent., of the 46 cases; and of the 37 positive blood cultures, streptococcus was present in 31, or 84 per cent. From this we conclude that by far the most important cause of death in wound cases was a bacteriæmia, and that a large majority of those bacteriæmias were due to streptococcus. Moreover, even if one should consider that all the cases without a record of blood culture had no bacteria in the blood, the incidence of streptococcus bacteriæmia among the 72 fatal cases would still be 43 per cent.

TABLE III  
*Causes of Death in Fatal Cases—Bacteria Found.*

	Streptococcus	Staphylococcus	B. coli and B. proteus	Pneumococcus	B. mucosus capsulatus	B. subtilis	B. Welchii	Vibrio septique	B. sporogenes	B. tetani	Total cases.
Septicæmia pyæmia											
Septico-pyæmia.....	31	6	6	3	1	1	2	..	..	..	37
Broncho-pneumonia.....	6	3	1	2	..	..	..	..	..	..	5
Lobar pneumonia.....	3	4	2	2	..	..	..	..	..	..	5
Lung abscess.....	1	..	1	1	..	..	..	..	..	..	2
Infected hæmothorax.....	1	3	1	..	..	2	..	..	..	..	3
Meningitis.....	3	2	1	..	..	..	..	..	..	..	5
Peritonitis.....	..	1	1	..	..	1	..	..	..	..	1
Arthritis.....	5	2	3	..	..	2	4	..	..	..	6
Gas gangrene.....	4	4	2	..	..	1	4	..	1	1	9
Wound cultures.....	19	17	15	..	1	5	10	2	3	4	30
Sterile cultures of heart's blood...	..	..	..	..	..	..	..	..	..	..	9
Total deaths.....											72

*Opinions Regarding the Practical Value of the Culturing of Wounds Under Circumstances Permitting Only a Limited Study.*—Under the conditions of rush which prevailed most of the time at the hospital where this work was done, rapidity was of practically the same essential importance as accuracy. On account of the volume of work to be done by a limited personnel, simplicity of technic and material used was also of importance. We found that the following information could be furnished soon enough to be of value to the surgeon.

Streptococcus hæmolyticus and non-hæmolyticus could be identified with a fair degree of certainty within five to twelve hours simply by a

## THE BACTERIOLOGY OF INFECTED WOUNDS

culture on a blood-agar plate. The frequency and persistence of the streptococcus hæmolyticus and its evident importance in causing fatalities indicate the value of wound culturing, even if for this organism alone. Staphylococcus, though much less important, can be easily and quickly diagnosed from the same cultivation, hæmolyzing powers of the strains being noted at once. Other aërobes are apparently relatively unimportant but can be more or less accurately indicated from the same culture by colony characteristics and microscopic study. It does not seem to me that routine subcultures or further study of these organisms are worth while under such circumstances, except for special indications.

As to the anaërobes, the following has been our experience: A presumptive diagnosis of *B. Welchii* can be given in eighteen to twenty-four hours. A presumptive diagnosis of vibrion septique can often though not always, be given in twenty-four to forty-eight hours. *B. sporogenes* was diagnosed but not with assurance. The reports have been of value as indications for serum treatment. The early diagnosis of *B. tetani* could not be made with any degree of certainty. Under the circumstances, and with the methods used, no other anaërobes could be satisfactorily diagnosed within a time that would make the report of clinical value.

The practicability of wound cultures to govern the curative treatment of infections with anaërobes seems to me to be very doubtful. This is to be especially considered since figures indicate that the period of danger from anaërobic infection of wounds is the early period just after the reception of the wound, the period when complete bacteriologic study must of necessity be most difficult. It seems to me that the accepted prophylactic treatment now used so effectively to prevent tetanus infection should be extended to the prevention of the other principal anaërobic infections. This has already been done to a certain extent and could probably be further extended.

*Bacillus tetani* is a pathogenic organism, producing death by means of a soluble toxin. An effective antitoxin has been produced. The organism cannot be identified with absolute certainty in a very short time. Still, by the prophylactic use of the specific antitoxin in all wound cases, *B. tetani* has become one of the less-feared organisms.

In like manner, the other anaërobes of importance in wound infections produce death by soluble toxins. Effective antitoxins have been produced. Indeed, there is a considerable practical difficulty in developing a combined antitoxin effective against all the principal pathogenic anaërobes, or a means of conveniently inoculating a series of antitoxins effective against the several varieties. Still, for organisms causing death so early, and for organisms so difficult to identify rapidly and with certainty, the most effective treatment should be a routine prophylactic dose of serum for all cases of war wound.

SUMMARY

1. Anaërobes are prominent in the early bacteriologic picture of wounds but disappear in a short time. Aërobes become progressively more prominent. The streptococcus has a fairly constant incidence and is very persistent.

2. A combination of streptococcus hæmolyticus and staphylococcus aureus was the most common of all associations in wounds. That association was particularly frequent in fatal wounds. Streptococcus hæmolyticus, staphylococcus aureus, bacillus Welchii, bacillus coli communis, bacillus proteus, and to a less extent, staphylococcus albus, were the bacteria appearing most often in both the fatal and non-fatal cases.

3a. (1) The prognosis seems to have been good in cases showing staphylococcus aureus or other aërobes aside from streptococcus. Here the most interesting point is that an association with staphylococcus aureus seemed to lower the virulence of infection with anaërobes.

(2) Infections with anaërobes showed a high death rate, but a short period of danger to life, unless the anaërobes were associated with streptococcus.

(3) Deaths from streptococcus infection were numerous and occurred at least up to the end of the fourth month. The mortality was even higher where streptococcus was associated with staphylococcus aureus or with anaërobes.

3b. Conversely: Cases fatal early usually showed anaërobic infection; those dying late invariably showed streptococcus infection. Most of the early improvements and cures were cases of infection by aërobes other than streptococcus, while the improvements and cures that were tardiest generally showed infection by streptococcus without anaërobes, or by streptococcus and staphylococcus aureus without anaërobes.

4. Secondary suture of wounds failed in some cases apparently because the interval between the injury and primary surgical treatment had been too long, and in other cases because the secondary suture was attempted too soon.

5. Gas infection was most often found in wounds of heavily muscled parts of the body; fracture of bone was not an essential factor; anaërobes frequently contaminated without infecting wounds.

6. A streptococcus bacteriæmia was apparently by far the most important cause of death in cases of gunshot wound.

7. The culture of infected wounds is certainly valuable, even if only for the purpose of determining the presence of streptococcus hæmolyticus.

NOTE.—The author wishes to thank Dr. W. J. Elser, of New York, formerly chief of wound bacteriology in the A. E. F., for valuable criticisms of the manuscript.



## PICRIC ACID IN OPERATIVE SURGERY\*

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OF NEW YORK, N. Y.

(From the Laboratory of Surgical Pathology of Cornell University Medical School.)

PICRIC acid,  $C_6H_2(NO_2)_3OH$ , a substitution product of phenol, has been used for many years in the treatment of extensive superficial burns, a 1 per cent. watery solution being employed. It has also been used largely by me during the past ten years in the treatment of minor cuts, extensive abrasions, severe contusions, and for minor operative surgery. Its advantages over iodine were its cheapness, its stability, its mild anæsthetic properties, and especially its lack of toxicity and irritation. Its one disadvantage was its tenacious and loud coloring of everything it touched.

During the war picric acid in 5 per cent. solution in 95 per cent. alcohol became very popular in the British Medical Service and proved quite efficacious. It was adopted, at Professor Gibson's suggestion, by the First Surgical, or Cornell, Division of the New York Hospital and has been in use now about two years. It has met with approval by all the members of the attending staff and will continue to be used until something better is offered.

A number of problems at once present themselves in relation to the use of any skin antiseptic, such as absence of irritating qualities, penetration, rapid bactericidal action, etc. The bactericidal properties of picric acid have been worked out by Doctor Wheeler of the bacteriological department and are appended.

Picric acid in 5 per cent. alcoholic solution can be applied with impunity to any part of the body except possibly the conjunctiva. I have never seen, after ten years' use, any signs of irritation from the picric acid itself, even when repeated many times at frequent intervals. Care must be taken, however, not to tan the skin too much, or blebs may form in the deeper layers and eventually mild infections ensue. This is especially true about wounds already infected, as a marked scab formation results and pus retention may occur beneath the scab.

Portions of the body subject to marked intertrigo must be watched after the use of picric acid with occlusive or irritant dressings, but less so than after the use of iodine.

Irritant chemicals such as bichloride of mercury, iodine, etc., must be used with reasonable care in conjunction with picric acid. Finally, dressings saturated with picric acid become exceedingly inflammable when dried.

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\* Read before the Surgical Section of the New York Academy of Medicine, March 5, 1920.

With the aid of Doctor Spencer and Doctor Kingery, of the New York Hospital, a number of experiments on guinea-pigs were carried out to determine the effect of picric acid on the peritoneum. Four healthy pigs received intraperitoneally hypodermic doses of picric acid in watery solution ranging from 2 c.c. to 1 c.c. 1 per cent. solution, and .05 to 1 c.c. of 5 per cent. solution. No ill effects whatever were observed, except that the pigs seemed slightly shocked by the peritoneal irritation.

Laparotomies were performed under anæsthesia upon these same four pigs at the expiration of six weeks. No adhesions were found and all organs appeared perfectly normal. The only preparation for these laparotomies was an application of 5 per cent. alcoholic picric acid solution to the skin, without shaving. The operator's hands were not washed, but were dipped in the picric solution. The intestines were allowed to protrude freely onto the abdominal wall and were subjected to quite rough handling with dry gauze.

The wounds were sutured and all four pigs made an excellent recovery. One died at the end of six weeks from abortion. All were subjected to post-mortem examination by Doctor Spencer and nothing abnormal was found. The conclusion seems justified that in guinea-pigs, at least, picric acid in rather large amounts does not tend to cause peritoneal adhesions. In this connection, I might also state that I have occasionally used picric acid on the stump of the appendix with no apparent ill effects.

Picric acid in alcoholic or watery solutions penetrates the skin only to the stratum corneum, as do other germicides. It is not to be expected of any of them that they can penetrate all the layers of the skin in sufficient strength to kill any of the more resistant bacteria. A certain degree of systemic absorption is said to occur, even to the point of intoxication, when applied over large areas, but it is hardly possible that germicidal properties in such dilutions have been preserved. Intoxication in any degree I have never observed even where very large surfaces were covered.

Portions of the skin were examined after treatment with 5 per cent. picric solution in 95 per cent. alcohol by means of frozen sections. The penetrating power is practically that of iodine. It must be remembered, however, that picric acid is an excellent mordant and decalcifying reagent, and its germicidal properties may last longer and extend farther for that very reason.

Skin scrapings were made after the use of the 5 per cent. picric acid solution in over thirty operative wounds. After the skin incisions were made the whole depth of the skin was thoroughly, deeply, and repeatedly scraped with a scalpel, taking care to avoid blood but endeavoring to obtain as much skin *débris* as possible. These scrapings were placed in broth tubes and then transferred to large broth flasks, so that the picric acid present might be diluted beyond any possible germicidal or even

## PICRIC ACID IN OPERATIVE SURGERY

antiseptic action. Moreover, these cultures were observed over periods of at least nine days in order that bacteria deeply hidden in the tissues might have every opportunity to develop.

Of the 27 cases in which we have been able to obtain the final result 16 were reported sterile throughout, while 11 gave growths of various kinds as follows: *Staphylococcus albus*, 5 times; *staphylococcus albus* and diphtheroids, 1; *bacillus subtilis*, 3; gram-positive bacillus, 2.

These results are about what one would expect when it is considered how thoroughly and deeply the skin scrapings were made. It is interesting to note that a similar experiment was carried out by a member of the house staff, who made repeated superficial skin scrapings on himself to the corium, using alcoholic picric acid in one series and iodine in a second series. All his cultures remained sterile.

It may be of some interest, although of no real scientific value, to state that of the 16 skin wounds reported sterile, 13 healed by primary union, 2 showed slight infection, and 1 had a moderately severe necrosis of the subcutaneous fat. Of the 11 cases which were reported not sterile, 8 resulted in primary union and 3 gave a slight infection. There was 1 infection in the wound which had been reported positive for *staphylococcus albus*, 1 positive for *bacillus subtilis* and 1 for the large gram-positive bacillus. These results are of no real significance, as the cases were unselected and were frequently contaminated at the time of operation.

It is not possible to conclude anything of positive value from the skin scrapings as to the efficacy of picric acid, except that, as was well known previously, no antiseptic penetrates all the layers of the skin with real germicidal power. In my opinion, the chief value of picric acid lies not in its germicidal power, but in its tanning qualities. I believe the bacteria are mechanically caught and held in the thick pellicle of tanned skin which develops after the use of picric acid. This prevents the bacteria from readily entering wounds during the operative procedure and holds them enmeshed until the wound is sealed. The condition of the lips of the wound at the end of operation is markedly different from that seen after the use of iodine. In the latter case the iodine is largely gone, into the wound, on the towels, sponges, etc., but with picric acid this is not so, practically all being present, no matter how long the operation. Indeed, one of the chief objections to its use is the difficulty of removing the stain.

A number of attempts have been made to find some reagent which would remove picric stain from the skin, but so far none with any great promise. Any of the sodium hypochlorite solutions will act, but slowly. The lime-and-soda scrub is more efficacious but hardly applicable where most needed, *i.e.*, on the face, neck and ears. Towels, dressings, etc., are readily decolorized by simple washing in cold water.

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provement in the end-results of our chronic appendicitis cases<sup>1</sup> since the introduction of the picric-acid technic. In former years our percentage of bad results in these cases was very high, running about 28 per cent. Since the introduction of the picric-acid preparation the percentage has dropped from 28 to 20 in 1918, and 11 in 1919. It was noticeable, also, that the great majority of these cases complained of pain in the immediate neighborhood of the incision, presumably due to adhesions. These complaints have become markedly less during the past two years. The criticism may be made, that our better results are due to other factors; but our technic has remained identical, with the exception of the introduction of picric acid, and it is hard to believe that diagnostic acumen and operative skill have increased to any such marked degree.

In conclusion, picric acid is ideal as a skin application preceding operation in that it never irritates and that it remains in the skin for a long period of time. Its only drawback is its rather startling color, which may annoy sensitive patients when exposed surfaces are stained. From the clinical standpoint, our results compare very favorably with those formerly obtained with iodine and with the older methods of skin preparation. I am fully aware, however, of the pitfalls of clinical observations uncontrolled by laboratory findings.

All methods of skin sterilization must necessarily fail of complete satisfaction. We are forced to employ those which experience proves reasonably satisfactory until such time as the bacteriologists perfect a universal or polyvalent immunization agent, to prevent and control sepsis from whatever source.

I wish to extend my grateful thanks to Doctors Stillman, Wheeler, and Spencer, of the Laboratory Staff of the New York Hospital, and to Doctors Kingery and Durfee, of the House Staff, for valuable aid in the technical part of this work.

#### RÉSUMÉ OF BACTERIOLOGICAL PROCEDURES

The tests to be described were carried out with samples of tincture of iodine and of 5 per cent. picric acid in 95 per cent. alcohol obtained from stock solutions in the operating room.

The phenol coefficients of these two solutions were determined by the United States Hygienic Laboratory method. With no organic matter present, the 5 per cent. picric acid solution had a phenol coefficient of 0.35; the tincture of iodine, a coefficient of 15.5. In the presence of organic matter—gelatin and peptone—the coefficients were

<sup>1</sup> Year	Per Cent. Unsatis- factory	Year	Per Cent. Unsatis- factory
1913 .....	28	1917 .....	24
1914 .....	23	1918 .....	20
1915 .....	28	1919 (6 months).....	11
1916 .....	26		

Gibson, Charles L.: The Results of Operations for Chronic Appendicitis. *Am. Journ. Medical Sciences*, May, 1920, No. 5, vol. clxx, p. 655.

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0.2 for the 5 per cent. picric acid solution and 12.5 for the tincture of iodine. A control test with 95 per cent. alcohol, no organic matter present, showed a coefficient of 0.15.

In determinations of this kind, intimate contact between the disinfectant and the test organism is assured, since they are mixed in a liquid medium and thoroughly shaken. The results obtained, however, give little information as to the efficacy of the disinfectant when applied to the skin, for in the latter case contact between disinfectant and organism depends upon the penetrating power of the solution, upon its ability to reach organisms that may be underneath the superficial layer of cells, in the ducts of sweat glands or in hair follicles.

In order to make the conditions of the tests conform more closely to those that obtain when these disinfectants are used for skin sterilization, the method devised by Elser and described by Connell<sup>3</sup> was employed. In this method the results depend upon the ability of the disinfectant to penetrate non-liquid culture media. Culture tubes of uniform calibre containing standard nutrient agar medium are inoculated, while the medium is liquid at 45 degrees Centigrade, with equal amounts of a 24-hour culture of staphylococcus aureus. After thorough mixing the medium is allowed to solidify. Equal quantities of the disinfectants to be tested are then added to the tubes, the cotton plugs are paraffined to prevent evaporation of the alcohol, and the cultures are incubated at 37 degrees Centigrade for 24 hours. A control culture to which no disinfectant has been added shows a uniform growth throughout the entire column of agar. The inhibiting effect of the disinfectant solution is shown by an absence of growth in that part of the medium nearest the disinfectant—that is, in the upper part of the agar column—and comparisons between different solutions may be made by comparing the heights of these zones in which no growth occurs.

Four disinfectants were tested by this method with the following results, the heights of the inhibited zones being expressed in millimetres:

1. 5 per cent. picric acid in 95 per cent. alcohol:	3. Alcohol, 95 per cent.:
Undiluted ..... 12 mm.	Undiluted ..... 10 mm.
1-10 ..... 3 mm.	1-10 ..... 2 mm.
1-50 ..... 1 mm.	1-50 ..... No inhibition of growth.
2. Tincture of iodine, 7 per cent.:	4. Phenol in aqueous solution:
Undiluted ..... 13 mm.	1-20 ..... 2 mm.
1-10 ..... 4 mm.	1-50 ..... No inhibition of growth.
1-50 ..... 2 mm.	

All dilutions were made with sterile, distilled water.

These results indicate that the practical value of a disinfectant may be more accurately estimated from a study of its penetrating power than from its bactericidal properties, as determined by phenol coefficient tests. The solvent employed in making such solutions also has an important bearing upon their action; iodine, when mixed with sterile vaseline in proportions of from 0.5 per cent. to 2.0 per cent., shows no inhibiting effect when tested in the manner just described.

<sup>3</sup> Connell, Karl: A New Disinfectant. Surg., Gyn. and Obst., July, 1918, vol. 27, p. 81.

## INTRACRANIAL AËROCELE FOLLOWING FRACTURED SKULL\*

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REPORTS of cases of air within the cranial cavity as a result of trauma to the skull are extremely infrequent. It has been thought worth while, therefore, to put on record an instance of this condition, and in addition, to summarize the cases previously reported in the bibliography so far as can be obtained.

In 1913 Luckett<sup>1</sup> reported the case of a machinist who received a fracture of the frontal bone from a trolley-car accident. Twelve days later he was apparently normal mentally. A week after this, periods of confusion and melancholy ensued. He had a leucocytosis of 15,000 and choked disks. X-ray showed the ventricles dilated and filled with either gas or air. At operation an opening was made in the right subtemporal region. Slight meningitis was noted. A needle was introduced into the right lateral ventricle and removal of the trocar was followed by spurts of air. An opening was made in the suboccipital region and a small rubber drain inserted into the cisterna magna. Cerebrospinal fluid mixed with air escaped from here also. The patient died on the fourth day after operation. At autopsy, air was found in the ventricles. The fracture was found to communicate with the frontal sinus, and over the fracture there was a laceration of the right frontal lobe. It was surmised that an attack of sneezing had forced air from the frontal sinus up into the ventricle.

Skinner<sup>2</sup> reported in 1916 a case of intracranial aërocele which lay beneath the dura of the right frontal lobe. The patient had sustained a fractured skull in a gas-well explosion four weeks previously, but complained of persistent headaches and dizziness. At operation the gas was collected from the cavity by putting a needle through the dura, and on chemical examination proved to be air from which a large per cent. of the oxygen had been absorbed. The origin of the aërocele was, therefore, probably from a crack extending into the frontal sinus. After a good operative recovery the patient succumbed on the twentieth day to meningitis.

In 1918 Holmes<sup>3</sup> reported the following case. The patient, an aviator, sustained a skull injury which the X-ray showed to be a linear fracture through both tables of the frontal bone, involving the frontal sinus. In addition to this fracture the plate disclosed a "large, oval, irregular area of diminished density in the frontal region." One week later symptoms of meningeal irritation developed and plates were repeated. The area of

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\* From the Surgical Clinic of the Peter Bent Brigham Hospital, Boston, Mass.

## INTRACRANIAL AËROCELE

diminished density was still present, but less extensive. A diagnosis of intracranial aërocele was made and the patient was operated upon. An area of bone was removed over the frontal region exposing dura, and the latter incised. Two ounces of turbid serum and air were evacuated from beneath the dura and the wound closed with drainage. The patient died of meningitis.

Holmes also quotes an unreported case of Doctor Dodd's in which there was air in the ventricles following a fractured skull. No further details were given.

Glenard and Aimard<sup>4</sup> in 1919 published details of a case of traumatic aërocele of the brain, in which attention was called to the sequence of events in the air-containing cavity. They emphasize the fact that no mental symptoms were present in their patient, although the defect was a relatively large one, occupying a position between the frontal and temporal lobes of the left side. The original injury was from a small piece of shell which entered the skull in the forehead, slightly to the left of the midline, and after traversing the left frontal lobe, made its exit through the temporal fossa. Several weeks after injury, X-rays of the head showed an air-containing area above and somewhat anterior to the region of the exit of the missile. A few weeks later still, this area contained partly air and partly cerebrospinal fluid, and there was a discharge of the latter from the patient's nose. Eventually the entire cavity became filled with fluid. The man died of intercurrent disease nearly a year after his injury. Barbé and Glenard<sup>5</sup> reported the autopsy finding, which consisted in a cavity containing 25 c.c. of lemon-yellow fluid, occupying a position between the left frontal and temporal lobes.

A case of hydropneumocranium with air in the ventricles was published in 1919 by Potter.<sup>6</sup> His patient, a man aged forty years, sustained a skull fracture without loss of consciousness. X-ray examination showed a stellate, comminuted fracture involving the frontal sinus. Inside the skull at the site of injury, there was a gaseous accumulation the size of a small hen's egg. Two weeks after injury there was an increase in volume of the subdural gas and partial filling of the lateral ventricle with the gas also. Two months from the time of the initial trauma all traces of air had disappeared.

In 1919 also, May<sup>7</sup> briefly outlined the findings in the case of a woman aged fifty-five years who had been knocked down by an automobile and remained unconscious up to her death twenty-four hours later. A post-mortem X-ray of the head showed numerous radiating fracture lines to the vault, base and into the frontal sinus. In the frontal region, apparently in the substance of the brain, there was a large air space.

CASE REPORT.—A. R. T. (Surg. No. 11081), a girl aged nineteen years. Admitted to the Peter Bent Brigham Hospital September 2, 1919. Family and past history unimportant.

## GILBERT HORRAX

*Present Illness.*—On June 9, 1919, she was thrown out of an automobile when it ran into a trolley car and was picked up unconscious. Taken at once to a local hospital; she was operated upon the same day. Notes from this hospital are as follows: X-ray examination showed a compound, comminuted and depressed fracture of the skull, extending from near the vertex, slightly to the left of the midline downward and forward through the left orbit. Linear fractures extended backward to the occiput, forward through both orbits, and presumably through the base of the skull. All loose bone fragments were removed at operation, and hemorrhage controlled. There was considerable laceration and loss of substance in the left frontal lobe. The wound was closed, leaving a small drain. Her post-operative course was uneventful.

She came to the Brigham Hospital on the service of Dr. Harvey Cushing three months after her injury because of (1) weakness of right side of face; (2) blindness of right eye; (3) deafness of right ear, and (4) loss of sense of smell.

*Neurological Examination.*—*Cranial nerves.* Olfactory—Complete anosmia on the left; nearly complete on the right.

Optic—Fundus O.D.—well-marked primary optic atrophy. Fundus O.S.—beginning primary optic atrophy. Temporal hemianopsia of left eye—not complete.

III, IV, VI.—Left pupil larger than right. Right pupil reacts very sluggishly to light, but consensual reaction is normal. Partial palsy of right internal and superior recti muscles. Slight ptosis of right eyelid.

Trigeminus—Normal.

Facial—Complete right facial palsy, with absence of taste on anterior two-thirds of right side of tongue.

Acoustic—Nearly complete loss of hearing—both air and bone conduction on right side.

IX–XII—Normal.

Cerebrum—The only indication of cerebral damage was referable to the frontal lobes. The patient seemed to be rather too casual in her attitude. She had almost no realization of her condition, and no special regret for the disfigurement of her face—facts which in a perfectly normal girl would cause considerable annoyance. No symptoms referable to the cerebellum.

Reflexes—Normal throughout.

No vasomotor or sphincteric disturbance.

Head—Palpation revealed a cranial defect over the left frontal region, extending from near the vertex down to the left orbit. X-ray of the skull showed an area of decreased density corresponding to the palpable defect in the cranium. It extended from the left frontal sinus upward for a distance of  $6\frac{1}{2}$  cm., and was 4 cm. in its greatest width.

Upon comparing this X-ray with some others which the patient had brought with her to the hospital, it was evident that another,



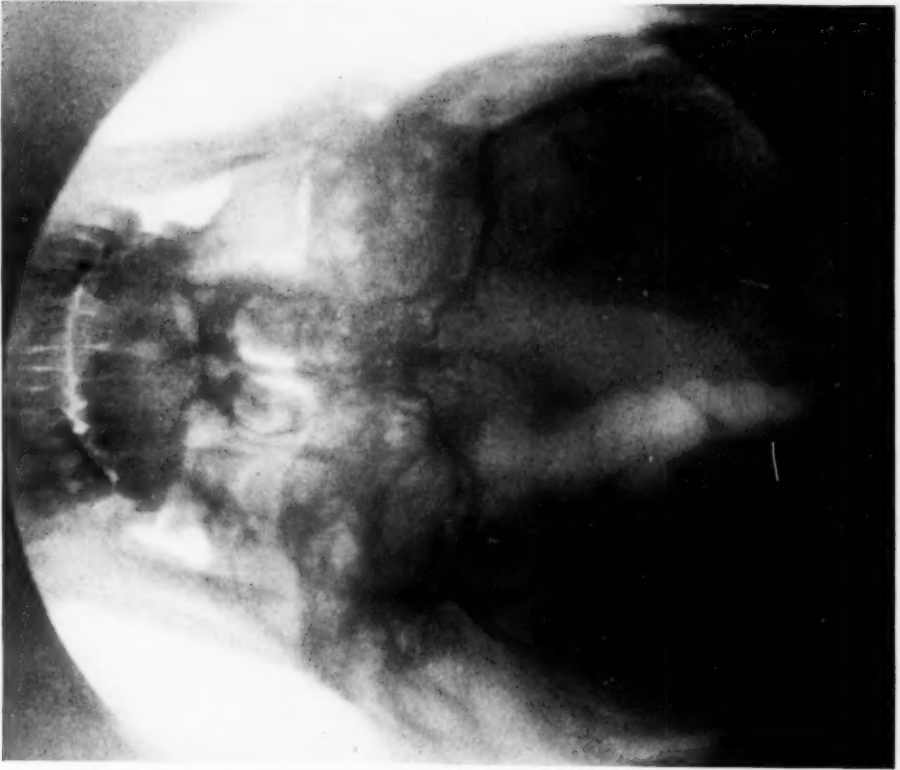


FIG. 1.—Antero-posterior view, showing cranial defect and air cavity.

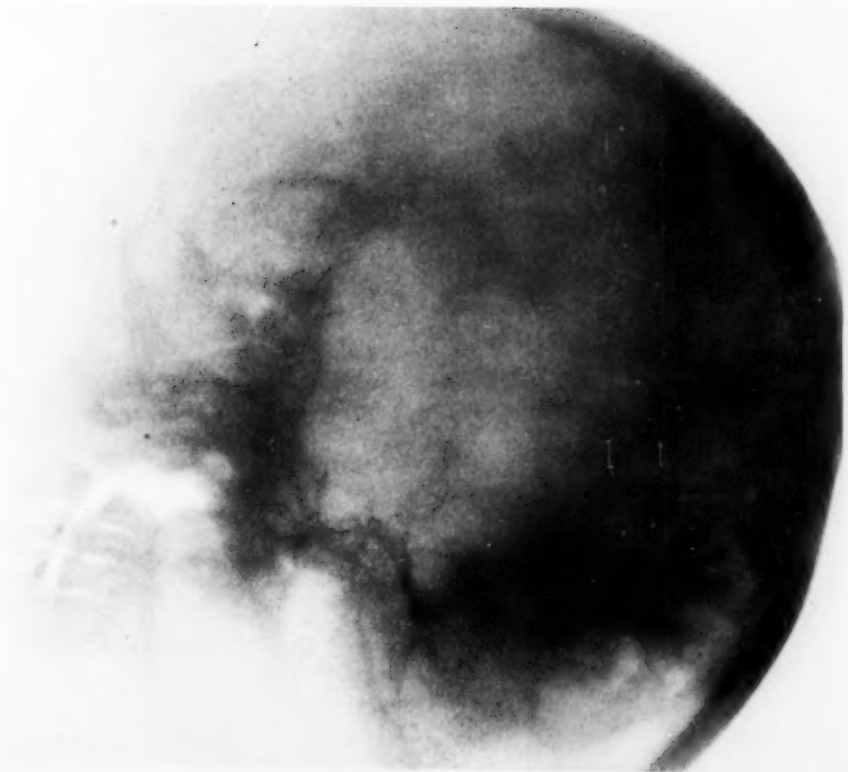
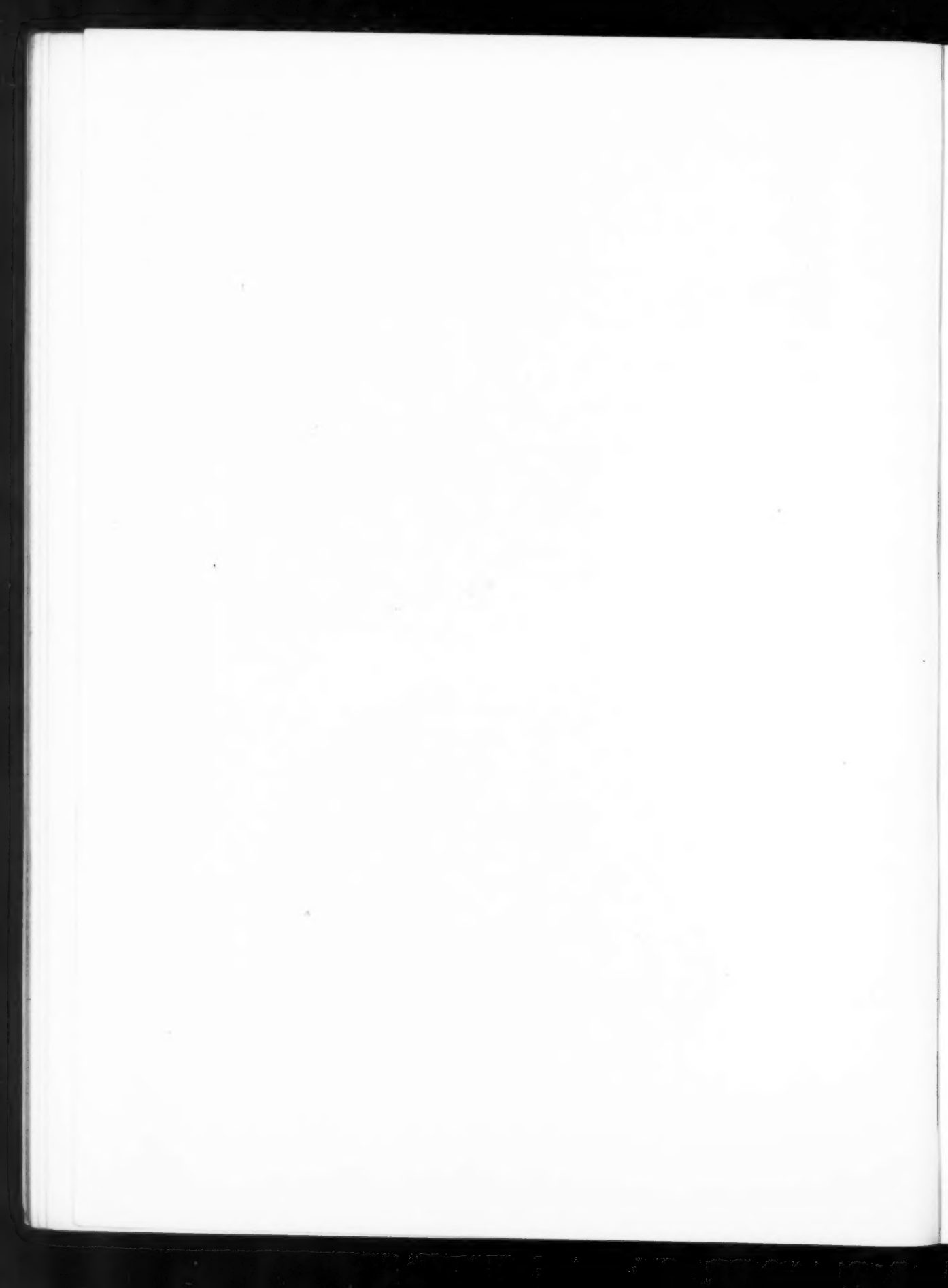


FIG. 2.—Lateral view, showing depth of air cavity.



## INTRACRANIAL AËROCELE

and somewhat different area of decreased density had been present at an earlier date, in addition to that due to the defect in her skull. The previous plates had been taken July 8, 1919, two months before her admission to the Brigham Hospital, and one month after her initial injury and operation. At this time they showed the area due to the cranial defect just as described above.

In addition to this area, there was to be seen underlying the bony defect, a lobulated shadow of decreased density (Fig. 1) which looked like a conglomerate mass of bubbles, the picture being such as to leave no doubt but that this irregular area represented an accumulation of air within the cranium. Its extension backward within the cerebral tissue of the left frontal lobe for a considerable distance was shown by the lateral plate (Fig. 2). The origin of this gaseous matter—presumably air—was unquestionably from a crack involving the frontal sinus.

*Discussion.*—As mentioned previously, there are peculiarly few accounts in the literature of such air-containing cavities in the brain, and this seems the more strange because the condition must occur fairly frequently after cranial injuries of many sorts, both gunshot wounds or fractures from other causes. Again after intracranial operations there must often be inclusions of air which lie surrounded by cerebral substance, either covered by dura, or below places from which the dura has been purposely removed. Apparently no specially significant features are associated with such inclusions, either in the way of subjective sensations, or in the manner of wound healing, except their possible relation to subsequent "traumatic cysts" as mentioned by Potter. Of the seven cases recorded, four died as a result of the injury or its complications.

Recently it has been shown experimentally by Dandy<sup>8,9</sup> that air can be introduced into the cerebral ventricles, or into the spinal subarachnoid space,<sup>10</sup> and this fact has been utilized clinically for the confirmation or determination of certain pathological intracranial processes. In Dandy's experience, no deleterious results have followed such injections, except an occasional headache which is easily relieved by ventricular puncture.

In regard to the time required for air to be absorbed from the cranial cavity we have little accurate information. In Skinner's case the residual nitrogen from a presumable original air inclusion was present four weeks after injury. That the nitrogen is the slowest of the air gases to be absorbed is, of course, well known, as this fact is made use of for therapeutic purposes in artificial pneumothorax.

Dandy says in his article on experimental introduction of air into the ventricles that, "day by day the air shadow diminishes and gradually disappears. In a case of internal hydrocephalus it required two weeks."

From the other case reports included here we get rather indefinite information. In the case of Glenard and Aimard there was a gradual supplanting of the air by fluid during the course of approximately two

months. Potter also, in his report, says that all traces of air had disappeared after two months.

In the writer's case, the skull injury occurred on June 9, 1919, but no reference to air within the cranial cavity was obtained until the plates of July 8, 1919, were taken. All that can be said is that between this time and September 2, 1919, when the final plates were made, the air had disappeared and had caused no serious symptoms so far as could be learned from the history. No operative measures seemed indicated and the patient was consequently discharged.

(I am indebted to Dr. Harvey Cushing for his permission to report this case.)

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## SQUAMOUS-CELL EPITHELIOMA OF THE THYROID

BY CLYDE AUGUSTUS ROEDER, M.D.

OF OMAHA, NEB.

THE title indicates a tumor of the thyroid gland which can not arise primarily from the normal epithelial structures of the gland, as the follicles are lined by a single layer of cuboidal cells. The gland develops from the pharyngeal mucosa, which mucosa during its embryonic state is of a single layer of columnar cells. This indifferent arrangement of columnar cells in single layer formation remains through the descent until the gland reaches its usual situation, where the epithelium is changed to a follicular formation of a cuboidal type. A reversion of this cuboidal type (post-embryonic) to a columnar (embryonic) in the adult thyroid results in hyperthyroidism. These changes, embryonic to post-embryonic, represent most striking examples of epithelial metamorphosis both in structure and function.

The foramen cæcum lies at the junction of the anterior and posterior portions of the tongue which developed from the body of the first and a portion of the second visceral arches and from the ventral ends of the second and third visceral arches respectively (Fig. 257, Kiebal and Mall, "Embryology"). About the same time the first pharyngeal pouch is formed the anlage of the thyroid appears and it lies between the first two ventral pharyngeal grooves, and the pharyngeal membrane, the dividing line between the ectodermic and endodermic cavities, disappears, leaving remnants also for possible inclusions. The endodermic and ectodermic portions of the pharyngeal pouches and pharyngeal membrane are in intimate contact before the thyroid starts its descent, and descending later between the anlagæ of the anterior and posterior portions of the tongue which are from the first, second, and third visceral arches, one can readily imagine an inclusion of a portion of these arches and membrane; which included portions later may proliferate, resembling malignancy of their related tissues (embryonically speaking). The basal layer of these misplaced tissues may proliferate, and if we accept Krompecher's classification of spinous and basal-cell epithelioma, we might expect spinous and basal-cell types in the thyroid. Probably the case of Delherm and Laignal-Lavastine, and Herrenschmidt's two cases (herein reported) might resemble the basal type, but photomicrographs or more accurate drawings must be presented for study. In the early embryo in the region of the stomodeum, pharyngeal membrane, branchial arches and pharyngeal pouches we have at first a simplicity of structure which later presents most varied and complex pictures, all derivatives of the cephalic intestine. According to Herrenschmidt, this region and its derivatives "possess from their formation an ectodermic tendency, which, trans-



mitted in the latent state to the basal cells of its adnexæ, is susceptible of becoming manifest on the occasion of the development of an embryonary tumor." Such complex epidermoid pictures, stratified squamous epithelium, basal and spinal, are not infrequently seen in epithelial malignancy of the compound diverticuli of the buccal mucosa (salivary glands).

Theoretically, a malignant proliferation of the cells lining the follicles of the thyroid might be called an epithelioma, resembling a basal-cell type, since these cells developed from pharyngeal epithelium; but since the cells of the embryonic pharynx have undergone such a marked change I think the term epithelioma from a structural and functional standpoint should not be applied to a malignant condition of the gland arising primarily from its follicles. Malignancy of the normal follicles of the thyroid, being glandular in function and arrangement, should be termed adeno-carcinoma, and can be divided into four major types, with varying pictures between, depending upon the primary cellular proliferation of the gland.

The first type is the proliferation *en masse* of a portion of the gland whose follicles have never functioned, such a portion in its benign state being known as a fetal adenoma. When a portion of this embryonic structure (fetal adenoma) becomes malignant it retains its original structure and the microscope shows masses of fetal follicles lined by a single row of cells advancing *en masse* as a new growth. This we might call *embryonal adeno-carcinoma* (Fig. 1). The second type shows the proliferation of adult follicles advancing as a malignant mass with also proliferation of the cells lining these malignant follicles but not penetrating the basement membrane. This we might call *adult follicular papillary adeno-carcinoma*, because the follicles of the adult type are proliferating as a whole and are in turn lined by proliferating cells resembling papillæ (Fig. 2). The third type is probably the most frequent and represents a proliferation of the follicles *per se*, in which the typical glandular formation is adhered to. This type we can term *plain adeno-carcinoma* (Fig. 3). The fourth type is the proliferation individually or *per se* of the epithelial cells lining either the adult or the fetal follicles, which proliferation penetrates the basement membrane showing masses of cells advancing without structural formation. This is the only type that shows cells advancing *en masse* with no basement membrane surrounding any portion of the cells, and is known as *plain solid carcinoma* of the thyroid because it has no other formation and cannot be classified as any other type (Fig. 4). It is less frequently seen than the first two types.

In describing a case of primary epithelial malignancy or carcinoma of the thyroid, the above terminology might perhaps be used in order to standardize the pathology of the gland. Epithelioma of the thyroid should be reserved for that extremely rare state in which the malignant picture is made up of stratified squamous epithelium resembling stratified squamous-cell epithelioma of the skin (Figs. 5 and 6). The French and

## SQUAMOUS-CELL EPITHELIOMA OF THE THYROID

German authors frequently use the term pavementous epithelioma, which we might accept as a squamous-cell type. Squamous-cell epithelioma or just plain epithelioma of the thyroid is extremely rare. Twenty-two cases are reported as epithelioma, but nine only are acceptable, nine doubtful, and four can be definitely ruled out.

### ACCEPTED CASES

CASE I.—BUFNOIR and MILIAN: *Epithelioma pavimenteux du corps thyroïde ayant pénétré dans le trachée*. Bull. Soc. anat. de Par., 1898, lxxiii, 251.

Case, female, aged fifty-two years. "Entered hospital for cough and severe dyspnoea, dying a few hours later. Presented a tumor in the thyroid (which side not stated) of six months' duration, size of an orange, very hard, whitish in color on cross-section, with vegetations on the interior of the trachea which tended to obstruct it. Lymphatic nodes of the neck were not involved. Histological examination showed the tumor to be a characteristic pavement epithelioma, very rare and arising from inclusions of the external capsule of the gland (Wölfler)."

NOTE.—The capsule is fibro-elastic tissue, of mesodermal origin and would more likely result in sarcoma.

No metastases were reported.

CASE II.—LÜCKE, A.: *Cancroid der Schilddrüse mit sehr acutem Verlauf*. Arch. f. klin. Chir., 1867, viii, 88.

Case, male, aged thirty-six years. "No history of goitre. One year ago left side of the neck enlarged with local pain. Difficult respiration began with the tumor formation. Tumor removed, but patient died a few days later from septicaemia. Autopsy showed larynx, trachea and oesophagus compressed as well as both carotid arteries. The tumor lay mostly beneath the left clavicle, compressing the left subclavian vein. There were four walnut-sized lymph-glands adjacent. Histological examination showed indifferent cell formation, some with the structure of spindle-cell epithelium and others with pavement epithelium. The majority of the characteristic epithelial cells were filled with fat, with here and there colloid globules."

NOTE.—The author did not mention pearl formation. His diagnosis was a cancrioid of the thyroid. The rapid growth was the particular feature. Evidently he considers this a squamous epithelioma if his idea of a cancrioid is similar.

CASE III.—SAVY, P., and FLORENCE, G.: *Epithelioma ectodermique du corps thyroïde*, Prov. Med., 1913, xxiv, 77.

Case, female, aged seventy-five years. "Comatose on entering hospital, no history. Tumor in right side of thyroid and large masses in iliac fossa. Autopsy showed a large yellowish colored mass, containing no blood-vessels. Left lobe not involved, but contained benign adenomata. Nodular masses found in the kidneys, suprarenals, liver, pancreas and lungs. Histological examination showed the thyroid tumor and the metastases of the same structure; viz., numerous epithelial globules formed of narrow concentric cells of ectodermic origin."

NOTE.—This tumor grew in the right side and metastases were found.

CASE IV.—BONN, H. K.: *Malignant Epithelial Growths of the Thyroid*. Jour. Ind. St. M. A., 1919, xii, 67.

Case, male, aged fifty years. "Tumor upper pole thyroid twenty years, recent growth with change in voice and spells of choking. Operation removed mass 5 x 3 inches and isthmus. Extension found in deep planes of neck. Pathologist reported no normal thyroid tissue in this tumor, which consisted of

squamous epithelium with many laminated whirls of flattened cells. Diagnosis squamous carcinoma of thyroid."

NOTE.—There were no reports of metastases.

CASE V.—KAUFMANN, C.: *Sechs weitere Fälle von struma maligna. Deut. Zeitschr. f. Chir.*, 1880, xiv, 25.

Case, male, aged forty years. "Goitre since boyhood equally developed on both sides. Recently left side enlarged with pain in ear and shoulder of the same side. Difficult respiration and speech with pressure symptoms. A hard-feeling tumor the size of a child's head was felt in the left side of the neck, with involvement of the skin, and palpable lymph-glands in the neck. No operation, patient dying one month later. Autopsy showed tumor involving sternum and clavicle. The right lobe of thyroid was not involved, the trachea and œsophagus were markedly compressed and the lymph-glands along the carotid greatly enlarged but were not malignant. There were no metastases found any place. The tumor was pale and bloodless on gross section. Histological examination showed an irregular mass of cornmeal cells of a pavement type, arranged in cancrioid pearls, .04 x 0.1 mm. in diameter. The cancrioid cells involved the skin but no other tissue."

NOTE.—He states that this is the third case reported. Kocher, *Deut. Zeits. f. Chir.*, Bd. 91, relates a case which is evidently this one reported by Kaufmann. He ascribes the cancrioid, squamous-cell epithelioma of the thyroid to the remains of the thyroglossal duct, since the cancrioid is generally found on the left side, where the duct usually lies.

CASE VI.—BUSACHI, T.: *Cancro a cellule pavimentose della ghiandola tiroidea. Gazz. d. osp. e. d. clin. Napoli*, 1891, xii, 561.

Case, male, aged eighteen years. "Tumor in left lobe size of man's fist, compressing trachea and œsophagus against vertebræ. No metastases were found at autopsy. In gross the tumor was hard and of a pale yellow color. Under the microscope the tumor presented a large number of pavement cells of various forms, some of which had undergone cornmeal transformation similar to those in epithelial pearls; a typical pavement-cell epithelioma."

CASE VII.—WOLFENDEN, R. N.: Epithelioma of the Thyroid Gland and Trachea. *Jour. Laryngol.*, London, 1890, iv, 50-53.

Case, male, aged fifty-five years. "Trouble began six months previously with difficulty in swallowing, which gradually increased with loss of weight, dysphagia and dyspnœa. Hard, tender, freely movable tumor in right side, size of an orange; left side of thyroid negative and no enlarged glands. Laryngoscope showed large red swelling under vocal cords with marked tracheal stenosis. Died during operation. Autopsy showed growth in right lobe and isthmus of a pale yellow-grayish color, hard and bloodless, with the left lobe normal. Microscopic report; viz., squamous-cell epithelioma."

NOTE.—Autopsy was confined to throat and no report of metastases was given.

CASE VIII.—EPPINGER (quoted by Kaufmann): *Carcinoma glandulæ thyroidæ. Præger Vierteljahr f. prak. Heilkunde*, 11, 13.

Case, male, aged forty-seven years. "Ill several years, heart trouble and dyspnœa. Patient died in hospital. Autopsy showed a tumor involving tissue from the upper sternum to vertebræ, springing from the inner and under parts of the thyroid. The tumor involved the trachea, œsophagus, aortic arch, superior vena cava and surrounded by firm adhesions. The histological examination disclosed a pavementous epithelial carcinoma."

NOTE.—The author notes that only one other such case has been reported, that of Lücke, whose case was reported as a cancrioid, which is included in this series. From this reference and the use of the term pavementous epithelial carcinoma we can accept it as a true squamous-cell epithelioma.



FIG. 1.—Embryonal adeno-carcinoma. Malignant fetal adenoma. (Photo mic, furnished by A. C. Broders, Rochester.)

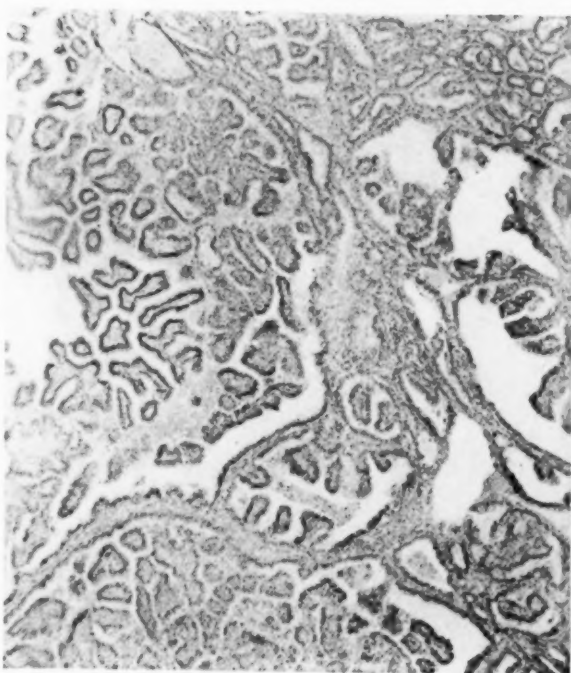


FIG. 2.—Adult follicular papillary adeno-carcinoma. The cells inside the follicles are proliferating and the follicles as a whole are advancing en masse. (Photo mic, furnished by A. C. Broders, Rochester.)

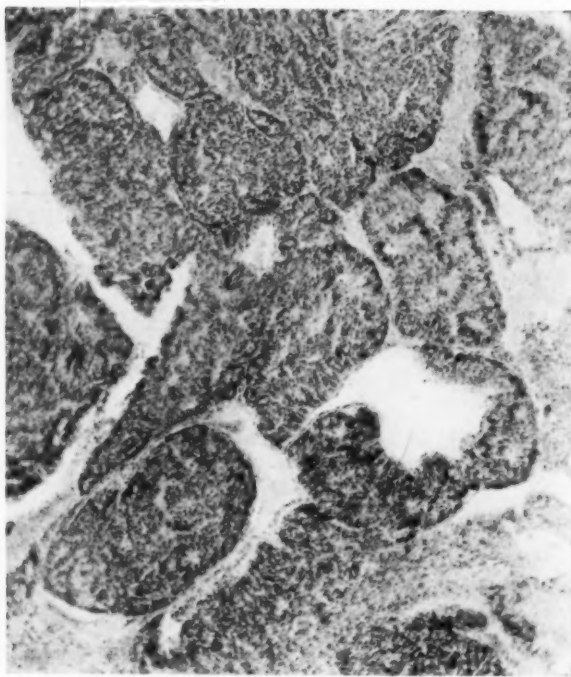


FIG. 3.—Plain adeno-carcinoma. The follicles are advancing en masse as a simple glandular structure. (Photo mic. furnished by A. C. Broders, Rochester.)

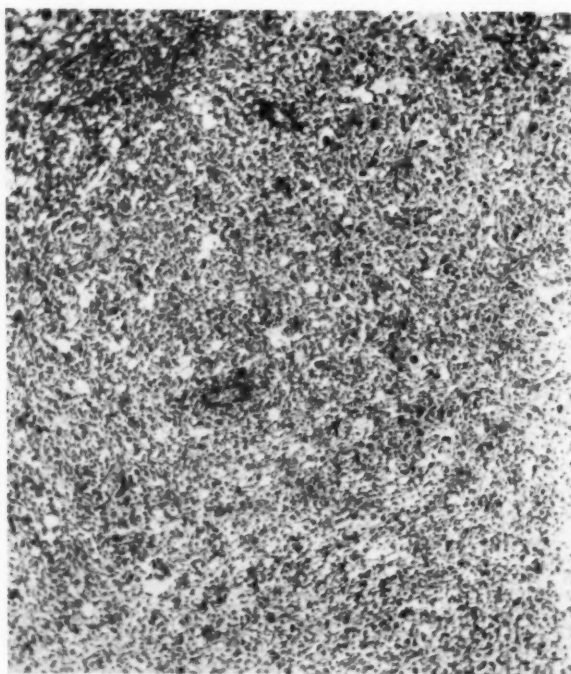


FIG. 4.—Plain solid carcinoma. The epithelial cells of the follicles advancing with no differentiation of structure. (Photo mic. furnished by A. C. Broders, Rochester.)





Fig. 5.—Squamous-cell epithelioma of thyroid. Note the large pearl of epithelial cells and below thyroid follicles. (Photo mic. furnished by H. E. Eggers, Nebraska University School of Medicine.)

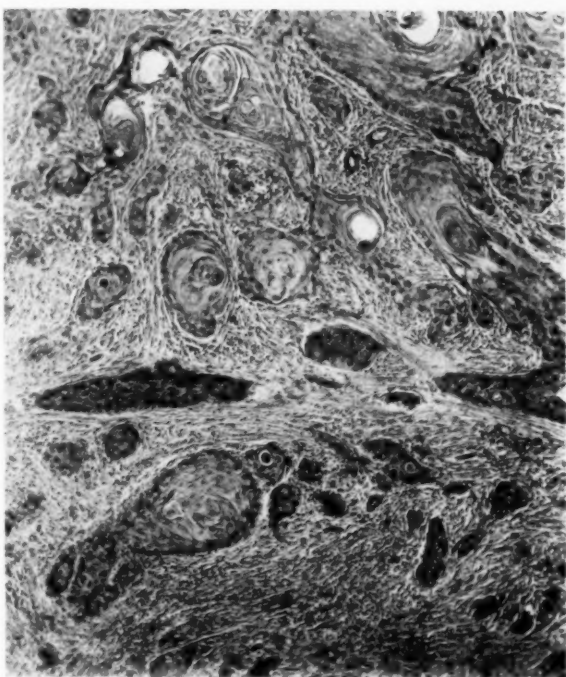


Fig. 6.—Squamous-cell epithelioma of thyroid. Note partly formations. Specimens adjacent to Fig. 5. (Photo mic. furnished by A. C. Broders, Rochester.)

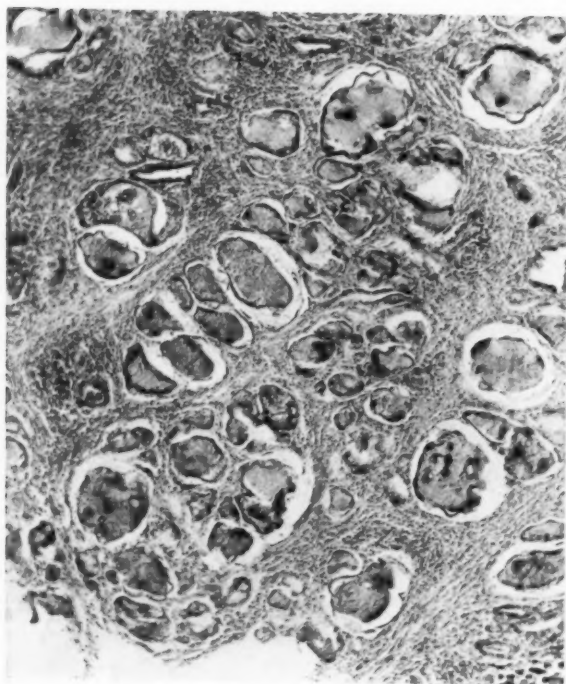


FIG. 7.—Atrophic follicles. Showing a specimen adjacent to Figs. 5 and 6 in which only atrophic thyroid follicles are found. (Photo mic. furnished by A. C. Broders, Rochester.)

## SQUAMOUS-CELL EPITHELIOMA OF THE THYROID

CASE IX.—MERMET, P., and LACOUR, R.: *Epitheliome tubule du corps thyroide, propagation laryngo-tracheale*. Bull. Soc. anat. de Par., 1896, lxxi, 791.

Case, female, aged fifty years. "Has had goitre three to four years past, with rapid growth past two months on left side particularly. The tumor was mobile, with the trachea and larynx hard but not tender. No enlarged glands, but a paralysis of the left recurrent laryngeal nerve. Autopsy following operation a few weeks later showed whole gland invaded, also larynx and trachea, with no enlarged glands. Histological report; viz., a tubular pavementous epithelioma of the thyroid type arranged in strands."

### DOUBTFUL CASES

CASE X.—DREYER-DUFER: *Epitheliome generalisé du corps thyroid*. Bull. Soc. Anat. de Par., June, 1893, lxviii, 410.

Case, male, aged sixty-six years. "Autopsy showed tumor originated from thyroid (did not say which side). Metastasis in liver, lungs, spleen and kidneys. Carcinoma of pylorus with metastasis to local lymph-nodes. Histological examination showed tumor of an epithelial tubular type involving thyroid, tending toward the fetal type of the gland."

NOTE.—Probably an embryonal adeno-carcinoma.

CASE XI.—LE FUR, R.: *Epitheliome du corps thyroide s'accompagnant de suppurations cervicales*. Bull. Soc. Anat. de Paris, 1898, ix, 261.

Case, female, aged fifty-nine years. "Histological examination showed a cylindrical-cell epithelioma."

NOTE.—The author does not give any histological details on which the diagnosis of an epithelioma was based, nor is a prototype suggested. The case is evidently not a true epithelioma.

CASE XII.—DELHERM and LAIGNEL-LAVASTINE: *Epitheliome primitif du corps thyroide*. Bull. Soc. Anat. de Par., 1902, lxxii, 354.

Case, female, aged forty-three years. "Autopsy showed tumor right lobe thyroid with metastasis to lungs and pleura. Left lobe normal. Histological examination showed tumor to be a cylindrical-cell epithelioma developed at the expense of the covering (revêtement) cells of the follicles of the thyroid."

NOTE.—This description suggests a basal-cell type. I am not sure what cells he refers to as the covering (revêtement) cells of the follicles.

CASE XIII.—BARBET, P.: *Epitheliome du corps thyroide avec metastases osscuses dans le sternum et dans une pseudarthrose du femur*. Bull. Soc. Anat. de Par., 1910, lxxxv, 233.

Case, female, aged sixty-five years. "A malignant tumor arising from the right lobe of the thyroid had extended beneath the sternum. Histology of one of the bosselated nodules of the thyroid showed the structure of thyroid with a covering layer of cubic epithelial cells and filled with colloid substance. The epithelium had proliferated."

CASE XIV.—MARTIN-DURR: *Epithelioma du corps thyroide; metastase dans les plevres et dans les deux humerus qui sont fractures spontanément; corps fibreux de l'uterus*. Bull. Soc. d'anat., 1894, lxix, 240.

Case, female, aged fifty-two years. "Autopsy: Soft thyroid tumor easily separated from surrounding tissue and when incised showed marked vascularity. Metastasis to lungs and pleura. Histological examination showed an epithelioma of the thyroid with small colloid cysts similar to physiological points of colloid degeneration of the gland."

NOTE.—The type of malignancy is not stated, and the author does not consider it rare.

## CLYDE AUGUSTUS ROEDER

CASE XV.—BRAUN, H.: *Beiträge zur Kenntniss der struma maligna*. Arch. f. klin. Chir., 1882-83, xxviii (Case 3), pp. 303-305.

Case, male, aged forty years. "Autopsy found mucosa of œsophagus ulcerated and infiltrated with the same type of malignancy in the thyroid; viz., epithelioma, but the primary growth could not be determined. The cervical lymph-glands were enlarged with changes in liver, kidneys and intestine."

NOTE.—This case is doubtful, the tumor more likely developed from the œsophagus, as œsophageal epitheliomas are much more frequent. Metastases were not mentioned.

CASE XVI.—CORNIL: *Epithelioma du corps thyroïde*. Compt. Rend. Soc. de Biol. Paris, 1875, xxvii, 273.

Case, male, aged seventy-three years. "Autopsy showed greatly enlarged thyroid with a malignant tumor in the left lobe. There was also involvement of the pharyngeal mucosa evidently from the thyroid. No enlarged glands."

NOTE.—The author states that the tumor resembled neither true epithelioma nor carcinoma, and that no pavement epithelium is present.

CASE XVII.—HERRENSCHMIDT, A.: *Carcinome pavimenteux du corps thyroïde*. These. Paris, 1904.

Case, male, aged sixty years. "Autopsy showed tumor of thyroid in right side adhered to trachea and œsophagus, with a second mass involving lymph-nodes lying above the pericardium. Histological examination showed carcinoma involving the right lobe of the gland with metastases to lymph-nodes surrounding the trachea and anterior mediastinal nodes. The tumor resembled a transition baso-cellular carcinoma (parakeratotic), possibly due to a branchial inclusion."

NOTE.—It can be ruled out as not being a squamous epithelioma, although probably of branchial origin (endodermic).

CASE XVIII.—*Ibid.*—Case, female, aged forty-one years. "Autopsy showed tumor all through, but mostly in right lobe of gland. Histological report showed a solid carcinoma of a baso-cellular transition type, no doubt originating from the thyroid follicles."

### AUTHOR'S CASE

Female, aged sixty-two years. Married, three children. History of attacks of sore throat for many years; has had a uterine fibroid, size of a nine months' pregnancy, for twenty years. Noticed a small nodular goitre for over forty years which had caused no apparent symptoms. For about six months before being seen had noticed a gradual increasing mechanical dyspnœa and a small mass gradually increasing in size in the left lobe of the thyroid. During the previous two months severe choking spells occurred requiring sedatives. During the past few months there has been a dull aching sensation just beneath the upper end of the sternum, and a skiagram showed a substernal adenoma about two inches in diameter with the remaining thorax negative. The patient had been unable to lie flat during the past five months and at the time of the examination had to remain almost constantly in a sitting posture, and reclining occasionally on about three pillows. The examination found a patient under difficult obstructive dyspnœa, moderate cyanosis, pulse 100, blood-pressure S. 160, D. 70, with a mass in the region of the left lobe of the thyroid about 3 x 3 inches and apparently moderately fixed to the surrounding tissues. It felt hard and not tender, suggesting malignancy. The left lobe extended beneath the sternum, from which arose the substernal thyroid. A laryngoscopic examination found abduction and adduction of the left vocal cord absent, but no encroachment on the lumen of the larynx by any formation.

Owing to the obstructive dyspnœa, the presence of the substernal thyroid

## SQUAMOUS-CELL EPITHELIOMA OF THE THYROID

and an absence of a narrowing of the lumen of the larynx; an operation was decided upon to relieve the dyspnoea only, feeling that a cure of a malignant condition, if present, would be hopeless. During the ether anæsthetic patient became intensely cyanotic, requiring a hurried incision, and following the delivery of the substernal adenoma the cyanosis completely disappeared. On attempting to remove the tumor involving the left lobe it was found to be definitely malignant, but all the tissue possible was dissected free from the larynx and the œsophagus. Seventy-five milligrams of radium were placed in the space occupied by the tumor for ten hours. The patient did very well for about ten days, when attacks of dyspnoea set in which were difficult to account for, as the laryngoscope found nothing apparently obstructing the larynx. On the fourteenth day after the operation, following a severe coughing spell, the patient suddenly died. No autopsy could be obtained.

The right lobe of the thyroid contained numerous small degenerated adenomata, which were also present in the left lower lobe. The malignant tumor seemed to have originated in the region of the internal surface of the left upper pole, where the remnant of the thyro-glossal duct is most frequently found. On gross section it was of a pale gray color, hard and contained very few blood-vessels. There was no capsule, but the mass seemed to have advanced uniformly, displacing all tissue as it grew.

The microscope showed a typical stratified squamous-cell epithelioma resembling the same type of growth from the skin (Figs. 5 and 6).

In the ten cases of true epithelioma reported here, including mine, there are a few clinical deductions of interest. The duration of symptoms was short, none over twelve months, and the growth rather rapid. The tumor was found in five on the left side, in two on the right, and in three not stated. Metastases were reported once, a complete autopsy being performed in this case. In the remaining cases, with no metastases stated, complete autopsies were reported in only three. The clinical signs suggested few metastases, and from a study of this series one cannot help but incline toward the view that metastases are unusual. The tumors were all hard, on cross-section bloodless and of a pale yellow or light gray color, and seemed to supplant uniformly all other tissues as they advanced.



## BRONCHO-PULMONARY FISTULA

ITS IMPORTANCE AS A FACTOR IN ACUTE AND CHRONIC EMPYEMA

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IN THIS communication the term "broncho-pulmonary fistula" is a general expression for a lesion in which a sinus is present between the bronchial tree and the surface of the skin of the chest. It is used interchangeably with other expressions, *viz.*, bronchial fistula, broncho-pulmonary-pleural fistula, broncho-pulmonary-pleural-cutaneous fistula and broncho-cutaneous fistula. The more definitive terms are used where the text requires it for purposes of clarity.

No military injuries are included; nor lesions due to infection with tuberculosis, actinomycosis, etc.

Under the newer methods of treatment there has been a pronounced improvement in the results obtained with operations for empyema. These methods are based upon the more accurate conception of the underlying pathology; upon a more precise knowledge of the proper time at which to operate; upon the realization that the simplest operative procedure is usually the best; upon the greatest care and attention to detail in the after-treatment; and upon the use of the Carrel-Dakin method of chemical sterilization in appropriate cases.

Less frequently than heretofore the sinus in the chest wall fails to close within a reasonable length of time. Our studies have shown us very definitely that when an empyema fails to heal within this time some very determinate factor is present which prevents the healing and obliteration of the cavity. Difficulties arise with the interpretation of the phrase "reasonable time"; for a length of time which seems unreasonable to one is regarded with indifference by another. My own experience has led me to the opinion that in any case a "reasonable" length of time ought to be a very long time indeed, and I am accustomed to wait this very long time and to give the wound every chance in the world to heal spontaneously, especially when I have made sure that drainage is perfect and no unsurmountable obstacle to the cicatrization of the wound is present. I was very much influenced towards this opinion by the manner in which the wound healing took place in the following case:

A middle-aged man was operated upon by rib resection for a post-pneumonic empyema; the sinus persisted for fifteen months, at the end of which time I saw the man for the first time. A small opening was present in the chest wall which discharged some foul pus; the Röntgen-ray showed a homogeneous shadow covering the

## BRONCHO-PULMONARY FISTULA

whole of the involved side. A radical operation having been determined upon, the chest was opened widely through an intercostal space and the incision was prolonged upwards, posteriorly, parallel to the spine with division of the ribs (Torek). An enormous cavity was disclosed reaching from the very top to the very bottom of the thorax and fully as wide as the depth of the chest. Owing to the presence of a large amount of very foul pus the intention to proceed with an extensive thoracoplasty (Schede) was temporarily abandoned until the suppuration could be controlled and the granulating membrane partially sterilized. The wound was left wide open and was dressed according to the Carrel-Dakin technic. At the end of six months the outer wound had contracted and closed down to a very narrow slit. I had hoped from the way the wound had been healing that any further operation would be unnecessary; but at that time six months seemed "unreasonably" long and I determined to proceed with my original intention. On reopening the wound I was astounded to see that the original huge cavity had contracted down to a narrow gutter barely a finger's breadth in width. I am quite sure that if I had waited but a little while longer, the entire wound would have closed spontaneously.\*

There are a number of factors which can interfere with the closure of the thoracic sinus after operation for empyema. Practically all of these functionate by constantly reinfecting the cavity which is to cicatrize, and many of them are those which interfere with the proper sterilization of the wound with Dakin's solution. All of these may be roughly grouped into (1) those in which there is insufficient drainage at the external opening; (2) those with inadequate drainage due to the complicated structure of the empyema cavity (subsidiary loculi, etc.); (3) those with persistent foci of infection in the periphery of the empyema cavity (osteomyelitis of the ribs, etc.); (4) foreign bodies; (5) communicating broncho-pulmonary fistulæ. Over some of these we have almost perfect control, as, for example, a badly carried-out drainage or an osteomyelitis of the rib. Over others we have only partial control; such would be the empyemata which are not simple cavities, but in which the main cavity is complicated with subsidiary loculi; the drainage of the latter is at best imperfect.

In previous years much has been said about rigid cavities as efficient causes for the failure of closure of the thoracic sinuses. I do not believe, however, that the rigidity of the empyema walls—and here, of course, I speak of the visceral layer—is a primary phenomenon. I have the impression that it is distinctly a secondary process owing its presence to any one of the causes mentioned in this communication, which functionate as impediments to the healing by constantly reinfecting the cavity. The constant reinfection is conducive to an overproduction of scar tissue in the granulation membrane lining the cavity, and the superabundance, by its very massiveness, lends the unyielding qualities to the visceral sur-

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\* Private records.

face. A vicious circle is thus formed, so that frequently a pneumolysis of some sort is necessary to permit, or aid in permitting more rapidly, the expansion of the lung. But in very many cases the efficient removal, operative or otherwise, of the essential primary cause is followed by a progressive yielding of the membrane and an obliteration of the cavity. It is significant that with increased knowledge, much less has been said in the last few years of rigid cavities as causes for chronic empyema sinuses.

The more I see of empyemata the more I am convinced that the greatest obstacle to healing is the presence of a broncho-pulmonary fistula; over this impediment we have no control at all. The fistula may be so small as to readily escape demonstration. I feel sure that broncho-pulmonary fistula is a very frequent complication of empyema even in cases in which no disturbance in the healing is apparent and in which there is no inkling of its presence. This should not appear extraordinary, since the opinion is gaining ground that many, if not all, of the empyemata complicating pneumonia result from the superficial abscesses (Rosenbach<sup>1</sup>) which rupture into the pleural cavity. The importance of broncho-pulmonary fistula in causing chronic sinuses seems to be corroborated by the further observation that the largest number of chronic sinuses follow the meta- or post-pneumonic type of empyema. It seems that as a cause for chronic empyema sinus broncho-pulmonary fistula holds first place.

The subject of broncho-pulmonary fistula has up to the present not received the careful attention which it deserves. As one looks at the problem of empyema one cannot help but realize that in the vast majority of the cases the suppurative pleurisy is but a complicating condition secondary to a similar pyogenic process in its immediate environment—most often the lung.<sup>2</sup> There are other originating foci, notably those underneath the diaphragm. Those empyemata which occur as incidents in the course of bacteriæmias of one kind or another can be grouped with the lung-empyema cases, inasmuch as it seems from what we know that the mechanism must necessarily include an intermediate embolic lesion appearing near the surface of the lung which in turn gives rise to the empyema in a manner similar to that to be described. In actual practice, therefore, the lung-empyema cases form well over 85 per cent. of all cases of empyema. I think that an indeterminate number of the cases classified as "primary empyemata" (the latter about 11 per cent. in number) must also be secondary to some superficial pulmonary lesion, any and all evidence of which is not demonstrable during life, at operation, or in the fatal cases, at post-mortem examinations. The absence of this evidence is the reason for classifying these cases as "primary."

The primary lesions in the lung are essentially either pneumonic areas, either of the lobar or lobular type, or frank abscess formations. Combinations of the two also occur; the sequence begins in a pneumonia and ends in the liquefaction of the consolidated tissue and its conversion into a

## BRONCHO-PULMONARY FISTULA

suppurating focus. Rosenbach<sup>1</sup> was the first to suggest the probability that many of the meta- and post-pneumonic empyemata are directly induced by the rupture into the pleural cavity of small superficially placed abscesses resulting from similar foci of liquefaction in consolidated portions of the lung. What evidence we have seems increasingly to show that this mechanism is perhaps the most common—if not the only one—by which the ordinary forms of meta- and post-pneumonic empyemata make their appearance. In a number of instances I have been able to demonstrate these abscesses on the operating table. The observation of Rosenbach is also corroborated in the report of the Empyema Commission;<sup>3</sup> in the cases which occurred at the camps during the epidemic small abscesses, which often were multiple, were repeatedly found at autopsy in the superficial parts of the lung directly under the visceral pleura.

With the meta- and post-pneumonic empyemata the disturbance created by the production of the empyema is commonly at a minimum. The very nature of the process lends every assistance to this state of affairs. Commonly there is a pleurisy over the involved area and adhesions are the rule; the progression of the lesion is comparatively slow; the rupture takes place concomitantly with its efficient localization by adhesions; the static conditions within the thorax are not disturbed. The communication with the interior of the pulmonary parenchyma is comparatively small and is further rendered futile—very often only temporarily, however—by the pneumonic exudate surrounding and plugging it, thus effectually blocking any immediate free communication with a bronchus of any size. I have appreciated this latter fact very forcibly on many occasions. A patient would be operated upon for empyema and, apparently, the latter was one with no broncho-pulmonary communication. As the case was subsequently watched one distinguished that the primary pneumonia was being overcome. Then the presence of the broncho-pulmonary communication would be more or less suddenly discovered, frequently by the "gassing" of the patient during an irrigation of the sinus with Dakin's solution—this when previous irrigations had given no discomfort of any kind. Undoubtedly the complete resorption of the pulmonic exudate had much to do with the "opening up" of the broncho-pulmonary fistula.

With frank lung abscesses the picture is different, depending on the acuteness or chronicity of the suppurating focus. In the former of these two there is a comparatively acute abscess formation, probably of embolic origin, with soft, non-demarcating walls, frequently multiple, commonly with few or no physical signs, and very apt to cause perforations between the non-adherent visceral and parietal pleuræ. The latter accident becomes associated with a sudden increase in the severity of the symptoms and the clinical picture becomes associated with and characterized by high fever, marked dyspnoea and cyanosis, and other signs of a high

grade of intoxication; the picture is that of an hyperacute pneumothorax. Pathologically these abscesses are noted by the absence of surrounding areas of induration. The resulting empyema involves, practically, the entire pleural cavity; the exudate is distinctly purulent—rather thin and frequently sanious—very foul and very toxic. As far as I know almost every case of this kind goes on to a fatal termination.

The second variety includes the chronic lung abscesses. The most characteristic of these are the foreign-body intrapulmonary suppurations which follow aspiration of a fragment of tonsillar tissue during a tonsillectomy. Anatomically the lesion consists of a central cavity containing foul-smelling, brownish-red, grumous pus in which a multitude of aerobic and, especially, anaerobic organisms flourish; a limiting granulation membrane of firm consistence; and a wide surrounding area of induration merging into pulmonary tissue in which fibrosis, secondary bronchiectatic dilatation and atrophy predominate. The lesion may be single or multiple, and with it an advanced grade of suppurative bronchitis is associated. An adhesive pleuritis is almost the rule and is usually limited to the area of lung involvement. The process begins in obstruction of the bronchus with secondary infection. Of necessity from the very beginning a communication is present with a fairly large size bronchus; more or less free drainage of the abscess is constantly present into the bronchial tree; perforation through the visceral surface into the pleura is uncommon. Empyema is, therefore, likewise uncommon; a general empyema is rare and occurs in those very exceptional cases in which no pleural adhesions have formed. The empyemata which are found are comparatively small and localized, and the mechanism of their production becomes apparent from the anatomical structure in which one wall of the empyema cavity is formed by a much thickened parietal pleura and the opposing wall by suppurating membrane based on pulmonary parenchyma (pleural vomica). Bronchial fistulae are always present. Clinically the pathology is characterized by a prolonged period of illness, by a distressing cough, by fetid and profuse purulent sputum, by the evidences of progressive general deterioration and of local pulmonary involvement, and by characteristically definite roentgenographic pictures; the general character of the entire complex is largely determined by the presence of the bronchial fistulae.

This type of empyema complicated by bronchial fistulae is illustrated by the notes of the following case:

In a man, aged fifty years, a lobectomy was done for a "chronic lung abscess." The description of the pathology as demonstrated at operation and by a study of the removed specimen is as follows: The lesion was present in the lower right lobe. The anterior, mesial and diaphragmatic surfaces of the lobe are free from adhesions. The latter are, however, present at the postero-internal border of the lung as far forward as the ligamentum latum pul-



## BRONCHO-PULMONARY FISTULA

monum and for the entire extent of the latter from the pulmonary hilum to the base. In this location there is an empyema cavity containing several ounces of thick, yellow pus. The mesial wall of the abscess is a much-thickened parietal pleura lining the reëntrant angle formed by the bend of the ribs and the posterior mediastinum; the outer wall is pulmonary parenchyma, without vestige of visceral pleura, and in which the open ends of a number of bronchi of the second and third order are distinctly visible. The empyema lay for the most part within pulmonary parenchyma and really constituted the major part of the lung abscess.\*

The observations in regard to the mechanism by which lung lesions (pneumonia and lung abscess) are complicated by empyema is most important, inasmuch as it teaches that in the commonest varieties of empyema the latter occurs ordinarily only in the presence of a destructive lesion in the pulmonary parenchyma the progression of which involves the pleura by perforation. As far as the empyema is concerned there is no essential difference in the mechanism whether the primary lesion is a pneumonia or whether it be a lung abscess; the important point to remember is that in either case there is necessarily present a communication with the interior of the lung or bronchi or both. The difference, if any, is one of degree of virulence and toxicity of the offending organism; of the rapidity with which the process advances, with which the lung tissue is destroyed, with which the perforation takes place. The result varies with the presence, or absence, of pleuritic adhesions in the neighborhood of the pulmonary process; with the size of the perforation and its communicability with one of the larger bronchi. The size of the latter has mathematical relationships with the character of the initial pneumothorax, with the resultant disturbances of the static and dynamic conditions within the thorax and with the severity of the clinical manifestations which are presented. The whole picture is built around the presence of a broncho-pulmonary communication.

The demonstration of a bronchial fistula furnishes indubitable evidence of the presence of a suppurative process in the midst of the lung tissue. In the great majority of the cases the presence of the fistula is to be interpreted as proof of the priority of the pulmonary process to which the empyema is subsidiary. In the lung-abscess-empyema cases the communication is frequently multiple and is usually direct and extends almost always into one or more fair-sized bronchi of the second or third order; the usually profuse and foul sputum, present before operation, resembles in all particulars the pus of the abscess and of the empyema; but it immediately disappears following the adequate drainage of the empyema and of the pulmonary focus and reappears directly drainage is interfered with from any accidental or purposeful cause. Healing is tedious and prolonged and most often the bronchial fistula is

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\* Private records.

an insurmountable obstacle to the closure of the chest wall sinus until, and perhaps even after, a radical operation is done. In those empyema cases which are subsidiary to small superficial pneumonic abscesses (Rosenbach<sup>1</sup>) that rupture into the pleura, a communication with the bronchial tree is not always demonstrable, even though they are undoubtedly present; in much the smallest number a communication makes itself apparent when, for one or another reason, a fluid irritating to the respiratory tract (Dakin's solution) is introduced into the empyema cavity. The fistula may be tortuous and is narrow and communicates usually with one of the smallest size or terminal bronchi. The amount of infiltration around the sinus tract is at a minimum and the tissues are soft and pliable and have a tendency to fall together; facilities for healing are most favorable in these cases. It is the rule for these communications to heal spontaneously and close very quickly, and it is exceptional for them to cause any extraordinary prolongation of the cicatrization of the wound. Characteristically the amount and physical appearances of the sputum is independent of the contents of the empyema cavity, has no resemblances to the wound discharges, and depends for its production on any associated bronchitis which may be present or upon the liquefaction of the pneumonic exudate which had antedated the empyema.

In only a minority of the cases of empyema complicated with bronchial fistula is the evidence sufficient to indicate that the communicating sinus has resulted from the rupture of the empyema into some part of the bronchial tree. Such, for instance, would be so when an unrecognized liver abscess perforates through the diaphragm and discharges through a bronchus after having first created a subsidiary abscess in the intrapleural space; these occurrences, while quite well known, are relatively infrequent. With simple empyemata the discharge of pus into the respiratory tract is extremely rare; and probably when such an accident happens it indicates the rupture of a coexisting and perhaps unrecognized pulmonary focus. The experiences which I have had seem to show that the intrapleural abscess discharges much sooner on the skin (empyema necessitatis), or remains, practically in an unchanged state except for the progressive thickening and even calcification of the limiting membrane.

It is a different matter with the frank lung abscesses; free communication with the bronchial tree is almost the rule with partial or complete drainage of the pus in the sputum.

In the cases in which the broncho-pulmonary fistula fails to close spontaneously—and in the total number of empyema cases, these, as indicated previously, are very few—the structure of the fistulous tract and its relations to the sinus in the chest wall, the empyema cavity, and the interior of the pulmonary parenchyma depend upon the character of the initial pathology, the size of the bronchial communication, the structural characteristics of the empyema cavity and the amount and character of the healing which has preceded at the time the fistula is recognized.

## BRONCHO-PULMONARY FISTULA

Much of this has been alluded to and explained in the parts of this communication dealing with the primary foci causing the empyema. As one sees these cases in actual practice one of a number of conditions is present.

In some of the cases—and I have the impression that these comprise the least number—the healing of the empyema has proceeded to that point at which the entire cavity has become obliterated and a narrow sinus is present which admits the passage of a probe within the chest to an alarming depth, evidently well within the interior of the pulmonary parenchyma. The bronchial communication is readily recognized by the expiratory and inspiratory current of air passing to and fro through the fistula. If the latter be sufficiently large efficient respiration can be carried on through the opening in the chest wall, even when the mouth and nose are occluded. The boundaries of the sinus (Fig. 1) include (a) the entire thickness of the chest wall, (b) the thickened pleuræ, and always (c) in the cases which I have examined some extent of pulmonary parenchyma. The wall of the sinus is lined with granulation tissue from which a certain amount of purulent discharge is constantly forthcoming. With the usual narrow sinus the quantity of discharge is limited and small; but I have frequently noted, first, that as the acute inflammatory condition in the bronchial tree subsides this quantity diminishes and, secondly, if a new attack of bronchitis supervenes, as it so often does, the discharge from the sinus increases at a proportionate rate with the production of sputum and resembles the latter in all particulars. The constant presence of a low grade of inflammation in the bronchial tree with the superimposition of repeated attacks of acute inflammation, which is aided materially by any associated localized or general bronchiectasis, furnishes one of the most important causes\* for the constant reinfection of the fistulous tract and for its consequent refusal to heal.

In other cases an appreciable cavity is present. This may be comparatively small (Fig. 2); or it may be as large as almost the entire interior of one side of the chest (Fig. 3). There may be a single broncho-pulmonary communication (Fig. 2) or the latter may be multiple (Fig. 4). In one case, which I saw, there were several well-demarcated loculi in two of which broncho-pulmonary communications could be demonstrated (Fig. 4). The relationship of the part of the fistula lying within the lung tissue and the external opening in the chest wall is variable; frequently the former is at some inaccessible location on the visceral wall of the empyema. The proportion of discharge escaping from the opening in the thoracic wall which is derived from the pulmonary part of the fistula is not determinable, inasmuch as it is lost in the total much larger discharge derived from and escaping from the empyema cavity; and I

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\*Tuffier\* speaks of necrotic bronchial cartilages as efficient causes for the persistence of the bronchial fistulæ. In my own experience I have never seen this lesion in any civil case either during life or post mortem. I have the impression that Tuffier derives this observation from his military experiences.



FIG. 1.



FIG. 2.

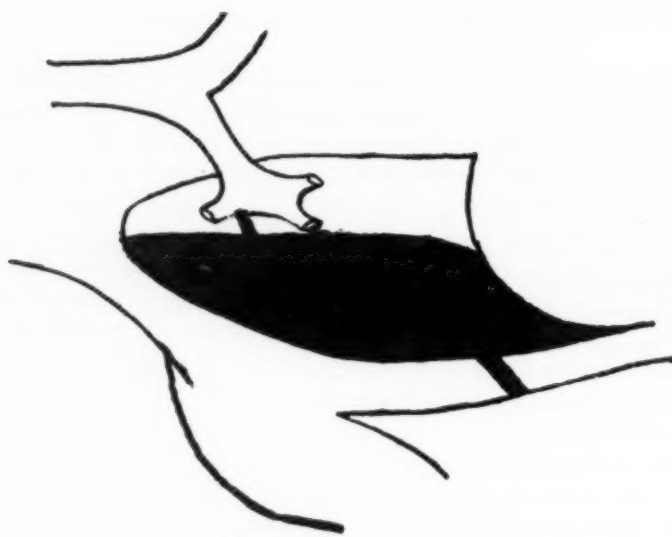


FIG. 3.

## BRONCHO-PULMONARY FISTULA

therefore have never been able to observe in these cases any increase in the discharge accompanying a recrudescence of, or any new inflammatory lesion in, the bronchi.

In any of the cases the continuity of that part of the fistulous tract lying within lung tissue is frequently broken by the intermediation of a larger or smaller pulmonary abscess. In conformity with the previously described pathology the latter may lie near the surface of the visceral pleura, deeper in the parenchyma, or closer to one of the large bronchi (Figs. 5, 6 and 7). Under these conditions it is more than probable that the perforation into the bronchus occurs in the largest number of the cases at some period subsequent to the perforation into the pleura and is due to a progression of the suppurative lung focus in its effort to secure more and efficient adequate drainage denied to it for various reasons (smallness of the opening, inaccessibility, etc.) at the opening in the visceral surface of the lung. Constant retention of pus within such structures is quite common and accounts, I feel quite sure, for many of the unexplained cases of fever developing during the course of the convalescence and during the healing of the empyema sinus. For similar reasons healing of the pulmonary abscess is very frequently impossible, and its persistence is the dominant cause for the constant reinfection of the entire fistulous tract including the empyema cavity and for an almost unlimited continuance of the latter.

In all of the cases which I have so far considered the sinus runs through a considerable depth of tissue. Even in the most favorable cases, in which the sinus is extremely narrow and straight (Fig. 1) and in which the bronchial opening is as near to the visceral surface of the lung as it is possible to be, the depth of tissue includes necessarily the thickness of the chest wall and a certain extent of lung tissue and is, especially in adults, at least three inches long. In the cases in which an empyema cavity is present the latter ought properly to be considered as forming an integral part of the complete fistulous tract (Fig. 2); of the latter the empyema is a ballooned-out portion. Similar consideration should be given to any coëxisting lung abscess (Figs. 5, 6 and 7). I make this point advisedly because one can readily see how futile it would be to do anything to the empyema alone (*i.e.*, one part of the complete fistulous tract) if the remaining portion of the fistula is not recognized and corrected.

One of the reasons very frequently given for the persistence of the fistula is that the skin epithelium, on the one hand, and the bronchial epithelium, on the other, grow inwards and outwards in the fistulous tract until, having met at a common point, the entire tract becomes epithelialized (broncho-cutaneous fistulæ). To be sure, the consummation of this process would make an insurmountable obstacle to any natural healing. I believe, however, that this is a very rare occurrence, and never in my experience have I been able to demonstrate this either to the naked eye or in microscopical section in any case operated upon with any minor pro-





FIG. 4.



FIG. 5.



FIG. 6.

## BRONCHO-PULMONARY FISTULA

cedure such as an intercostal incision or simple rib resection. I have seen this attempted and more or less completed epithelialization of a fistulous tract after extensive operations have been performed on the chest wall of which the object is the collapsing and healing of empyema cavities. In some of these cases the resultant wound is very large—frequently this is purposely made very large so that skin flaps can be swung into place to aid the cicatrization—and an enormously long and wide shallow gutter results. Then with or without the aid of skin grafts, or pediculated skin flaps, the epithelialization of the floor of this gutter, which is really visceral pleura, goes slowly on until the previously recognized or newly discovered bronchial fistula is reached. There it apparently stops but, in reality, becomes continuous with the bronchial epithelium, and when no inflammatory process of any kind is present in the bronchial tree, none or a very insignificant amount of discharge escapes from the broncho-cutaneous fistula and the patient continues so for an unlimited period of time in comparative comfort.

Given the establishment of any of the varieties of broncho-pulmonary-pleural-cutaneous fistulæ described in this communication the dynamics of the resultant intrathoracic conditions are such as are most conducive to its unrestricted persistence. It is certain that the most important reason for the obliteration of any empyema cavity is the constant exertion of a distending force produced by the inspiratory dilatation of the pulmonary parenchyma. If, for any reason, this is interfered with, a most efficient factor in the healing is destroyed. There are two ways in which this interference can occur:

1. The visceral wall of any empyema is an elastic membrane, and being the only movable part of the bounding walls of the cavity its gradual protrusion outwards towards the bony wall of the thorax is the only method by which healing finally takes place. In the ordinarily operated and drained cases the mechanical conditions are those illustrated in Fig. 8. The distending force working to obliterate the cavity *E* is the column of air entering the appropriate lung through its main bronchus *D*. In the presence of an opening in the chest wall a column of air is also simultaneously sucked into the empyema cavity at *C* and an additional opposing force is thus created tending to neutralize the distending power of the column entering at *D*. The constant factors in either force are the sucking power of the thorax and the atmospheric pressure; the variable factor is the difference in the size of the openings through which these forces work, namely, the diameter of the bronchus at *D* and of the chest opening at *C*. If the opening *C* is equal to or larger than that of the main bronchus at *D*, the opposing force to the latter is either equal to or larger than the distending force, the latter is neutralized, and no appreciable effect can be exerted on the visceral pleural membrane towards the distention of the lung and the obliteration of the cavity. In order to have the lung



FIG. 7.

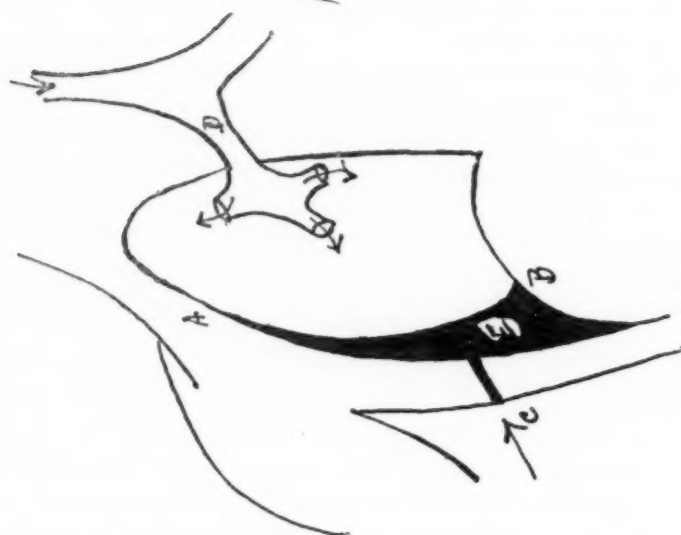


FIG. 8.

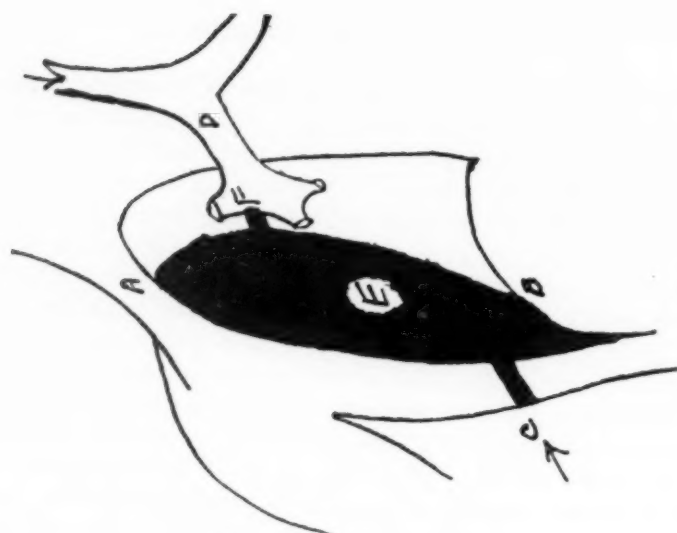


FIG. 9.

## BRONCHO-PULMONARY FISTULA

properly distended the calibre of the opening in the chest wall must be smaller than that of the main bronchus.

2. Even when the mechanical conditions indicated in the previous paragraph are as they should be, the distending effect of the inspiratory force can be completely nullified by the presence of a bronchial fistula. This is readily seen in Fig. 9: the column of air entering at *D* cannot possibly attain any efficient pressure because most of the latter is dissipated by the escape of air into the empyema cavity through the sinus at *F* (compare with attempts to blow up an automobile tire in the presence of a hole in the fabric). This is not only bad enough; it is rendered much worse because that part of the inspired air blowing through the broncho-pulmonary-pleural portion of the fistulous tract into the empyema cavity at *F* combines forces with that entering through the chest wall opening at *C*, and, instead of distention of the lung parenchyma, compression occurs (Fig. 9).

One can readily understand what a vicious circle such a fistulous tract of any kind would produce. The empyema cavity would tend to grow larger instead of smaller, and I have no doubt at all that many of the enormous cavities which one sees from time to time are formed in this way.

Various factors were enumerated in the earlier part of this communication which are capable of preventing the healing of any empyema; fortunately all of these are fairly easily demonstrable with the means at our command. In any individual case constant perseverance is necessary that these complicating factors are not allowed to occur to disturb the normal healing of the empyema; or that having occurred they be recognized and corrected without any undue waste of time.

With the exercise of care the presence of any bronchial communication ought to be recognizable very promptly in the greatest number of the cases. As pointed out previously in this communication, the largest number of the broncho-pulmonary fistulae close spontaneously; and if the recognition of the presence of the latter occurs in the early part of the course of healing of the empyema cavity it may be expected that closure will follow unaided, especially in the varieties of empyema referred to and described previously in this paper. Once, however, such a complete fistula becomes well established it can almost always be taken for granted that little or no advance in the healing of the sinus or broncho-pulmonary-pleural-cutaneous fistula will occur and that some radical operation will be necessary if a cure is to be obtained. Operation is, however, difficult and dangerous and the prospect of success is not always certain.

In those not associated with any bronchitis or other inflammatory lesion in the lungs and in which there is no appreciable empyema cavity but only a narrow sinus the disability produced by the latter is at a minimum, the care of the chest opening is one which the patient himself can exercise and the daily occupations and duties of the latter can be

carried out with no discomfort and with very little risk. To patients of this class, I believe, the actual state of affairs ought to be explained and they should be given an opportunity of choosing between the retention of the sinus with its slight inconvenience and the operation with its attendant dangers. Operation must necessarily include the excision of the entire fistulous tract, the adequate liberation of the affected lobe, or lobes, of the lung through a sufficiently large incision, the closure and inversion of the opening in the bronchus and its further guarding when feasible by some plastic procedure. In any case it is best to wait until the suppuration is at a minimum before undertaking any operation, otherwise retention abscesses occur.

If it can be determined that a lung abscess is also present in addition to the fistula, the closure of the latter might interfere with the drainage of the former and cause an increase in the pulmonary focus. Under these conditions the only operation that suffices is a lobectomy of the involved portion of the lung. It is needless to say that such a procedure is one of great difficulty, one in which there is the maximum danger both immediately and more remotely. The choosing of the proper case for the operation of lobectomy restricts the field markedly; for only with everything in the patient's favor can any success be expected, especially as regards the immediate outcome of the operation. So that in many, operation must be refused and the best be made of a wretched state of affairs. In appropriate cases some of the discomfort can, perhaps, be removed by intrabronchial washings of the abscesses (Yankauer). Even under the best of conditions the expectation of ultimate cure is, however, extremely small.

Just what one must do with the large empyema cavities complicated with bronchial fistulae of one kind or another is one of the difficulties of surgery. The fistula is not always demonstrable, even on the operating table. In the stubborn cases no one method of operation suffices for all. The two essential methods of attack are directed towards collapsing the chest wall (thoracoplasty), or towards aiding and facilitating the expansion of the lung (pneumolysis)—both of these with the object of securing a rapid cohesion of the large opposing surfaces. The closure of the opening in the bronchial tree and the excision of the pulmonary portion of the sinus tract, when the latter is of considerable length, is itself an undertaking; frequently the success of the larger and more extensive operation, indicated above, is nullified by the failure of that part of the operation directed towards the closure of the fistula. In any case, one should not limit one's self with any preconceived intention of adhering exclusively to any one essential type of operation; I am quite sure that in many of the cases every available type and method of operation (thoracoplasties, pneumolyses, various types of incision, etc.) ought to be considered and utilized in order to insure success.



## BRONCHO-PULMONARY FISTULA

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## OBSERVATIONS ON CHOLELITHIASIS\*

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IN looking over a series of the first thirty cases of cholelithiasis that I operated on at Bellevue Hospital (Cornell Division) after our follow-up system was first inaugurated, and ten cases in private practice during the same period, certain interesting facts appear, which hold in a larger series of cases. I have not taken more recent cases as the end-results are not yet shown in the return records. I refer also to other cases in private practice and to a few recent hospital cases.

Of the forty cases 67.5 per cent. were women. The age varied from twenty to sixty-six years, and the age of nearly half was from thirty to thirty-six inclusive, nearly all women, several of whom gave a history of the trouble commencing during pregnancy. The duration of the condition since its apparent onset varied from ten days to fifteen years.

Ninety per cent. had had more or less typical colic, while the symptoms were overshadowed by those of a concomitant duodenal ulcer in one case, and in another the pain was more constant than colicky. This is an unusually large percentage of cases with colic. Of course, it is easier to persuade a patient who has had colic to have an operation, than one who has merely had attacks of indigestion, which is what so many patients complain of in the early period of cholelithiasis. Of the cases with distinct colic, radiation of the pain to the back is noted in 63 per cent., to the back alone in 44.5 per cent., and to the back and right shoulder in 18.5 per cent. In two cases it radiated to the right shoulder alone.

In this series local tenderness over the gall-bladder is noted in 63.3 per cent., over the gall-bladder alone in 53.3 per cent., over the epigastrium also in 10 per cent., while in 10 per cent. there was tenderness over the epigastrium alone. Of course, some of these were operated in the quiescent period, which may account for the absence of marked tenderness in several cases. Incompleteness of the history may also account for the lack of mention of this symptom when present, and this may also account for the percentage of some of the other characteristic features.

Of the gastric symptoms noted, nausea, vomiting, belching, eructations and epigastric distress are the most frequent. One or more of these constitute the ill-defined indigestion, typical of gall-bladder trouble. The test meal is not diagnostic, except that the acid is more likely to be normal or low than to be high. The symptoms occur soon after eating and are not relieved by it. When colics are present the gastric symptoms have but little diagnostic importance, but in the early stages, or before the occurrence of colics, they are very suggestive.

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Jaundice was present at some time in 35 per cent. of the cases, including one who was told that she was somewhat yellow. This is a rather large proportion and shows again that this group represents late, not early, gall-bladder trouble. When we analyze these cases we find that the jaundice was due to stones in the common duct in seven, while in five it was due to a chronic pancreatitis, and in the others the history fails to mention the condition of the pancreas.

Pancreatitis is a complication that in my experience is more common in gall-bladder disease, as well as in duodenal ulcer, than was formerly supposed. This frequency corresponds with Deaver's view, who thinks that it is caused by a lymphatic infection from a primary infection in these two organs. The pancreas was noted as enlarged in 33.3 per cent., and in several the condition is not mentioned in the history.

There were stones in the gall-bladder alone in thirty-two cases, in at least eight of which one or more stones were impacted in the cystic duct. In the remaining cases there were stones in the common duct alone in three cases, including one where the gall-bladder was congenitally absent. In four cases they were present in both common duct and gall-bladder.

Although cases of cholecystitis belong in another group, a condition of cholecystitis was present in most of these cases, as is brought out by the pathological examination as well as by the appearance and condition of the gall-bladder, as disclosed by operation. In two cases the gall-bladder was constricted so as to form an hour-glass gall-bladder. It was thickened and contracted in 36.3 per cent., thickened in 36.3 per cent. more, adherent in 60.6 per cent., and enlarged in 30 per cent.

When the changes in the gall-bladder reach this stage, removal of stones and temporary drainage will not cure the pathological condition. A diseased gall-bladder is left which may be responsible for the formation of fresh calculi, the occurrence of exacerbations of cholecystitis or of chronic indigestion, often qualitative, causing chronic invalidism. In five cases the gall-bladder was whiter or more opaque than normal, and perhaps very slightly thickened, but otherwise normal. Such gall-bladders might perhaps return to a fairly normal condition after cholecystostomy.

The recurrence of gall-stones and of gall-bladder symptoms is illustrated in five cases (12.5 per cent.) which recurred after cholecystostomy, one six years, one eight years, and one nine years before, and one done in Holland fifteen years before. In general, I think that in most of the cases of so-called recurrence the condition is due to stones overlooked at the first operation. I have found these in the gall-bladder and in the common duct. Eisendrath has called attention to the ease of overlooking them in the common duct. In a more recent case at Bellevue the "recurrence" was in the stump of the cystic duct, probably an overlooked stone. In two of the five cases, which recurred after a previous cholecystostomy, there was a fistula into the gall-bladder, in the abdominal scar,

alternately closed and open, ever since the first operation, and I have had other similar cases. In such conditions a stone was evidently overlooked. In these cases when the fistula was closed there was pain or colic.

In other cases, from the length of the interval free of symptoms combined with a personal knowledge of the operation or the operator, it is reasonable to suppose that the gall-stones have formed anew. And why should they not? for in most cases the gall-bladder is left in a condition of chronic inflammation which, with the stagnation of bile, owing to the thickening and adhesions of its walls, furnishes all the conditions which favor their formation. One of the reoperated cases was a patient on whom I did a cholecystostomy in 1911. She was free from all symptoms for seven years, until three months before reoperation. There were five stones in the gall-bladder, which I am quite sure had reformed.

The chronic cholecystitis may of itself give symptoms, when exacerbations occur. Thus one of the reoperated cases was a patient on whom I had done a cholecystostomy many years before. The post-operative period of the first operation was complicated by an acute dilatation of the stomach, but he made a good recovery. At the second operation there were no stones, only a chronically inflamed gall-bladder, which was thickened and adherent, to account for the recent periodic attacks of pain and distress. He has remained entirely free of symptoms for over three years since the second operation.

Some of the operations for the recurrence of gall-stones or gall-bladder symptoms are most difficult and would strongly indicate, as a primary operation, one that would give the most security against recurrence, *i.e.*, cholecystectomy. Let me give some of the details of a very interesting case bearing on this point:

A patient came for the relief of a biliary fistula. For over a year all the bile had come from the fistula, the stools being acholic. He had had a cholecystostomy and then a second operation, an unsuccessful attempt to close the fistula. I made a probable diagnosis of stone in the common duct and this was found and removed, after a difficult dissection. But on introducing the finger up into the hepatic duct a group of stones was felt, lying in an expansion or pocket in or on the liver, beyond a constriction at the surface of the liver. Very possibly the stone in the common duct had come from this source, and perhaps after the cholecystostomy. With some difficulty these stones were removed, after dilating the constriction. A tube was sutured into the hepatic duct, as usual, but the drainage was almost pure blood. This soon clotted and blocked the flow of bile. Jaundice developed and rapidly increased, with rising temperature. The tube was pulled out after Bier suction had been applied in vain. This suction was reapplied at intervals to the sinus left by the tube, without result, and the general condition was becoming critical, the patient being very dopy and the temperature high. But as the blood-

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clot filling the bile-ducts contracted, in time a little bile found its way alongside of the clot. This kept increasing until a full flow of bile was established, the jaundice cleared up, the fistula closed, the patient made a good recovery and remained well.

Another distinct advantage in cholecystectomy is the prevention or occasional early removal of carcinoma of the gall-bladder. This is almost always associated with gall-stones and probably depends for its origin on their chronic irritation, and that of the accompanying inflammation. If we remove the gall-bladder after we can diagnose a carcinoma we will very rarely get it in time to cure the patient radically. A further advantage in cholecystectomy is the prevention of a pancreatitis, which may be due to infection from a chronic inflammation of the gall-bladder.

The chief difficulty in recommending cholecystectomy as the routine operation of choice lies in the fact that recurrences after cholecystectomy are more difficult to handle than after cholecystostomy. For one reason we have no gall-bladder for short-circuiting in case of chronic jaundice from stricture, etc., of the common duct. I had two such cases with chronic jaundice when cholecystectomy was first being used as a routine operation in a large variety of gall-bladder cases. This made me quite conservative for a time, for, unless due to an overlooked stone, the operative treatment is difficult. In a recent case operated on twice at another hospital, which entered Bellevue over three years ago with a biliary fistula of long standing, operation showed that the gall-bladder had been removed and that the common duct was not obstructed by stone or a tight stricture, but was largely compressed by scar tissue from without. The duct was liberated by dissecting away scar tissue, as the conditions were very unfavorable for an anastomosis, but it was doubted whether a permanent result would be obtained. He left the hospital with a biliary fistula, but fortunately this closed the next day and has remained closed since.

I have recently operated for stones in the common duct where a cholecystectomy had been done in another hospital eighteen months before. On account of the symptoms in the interval I feel sure that these stones had been overlooked at the first operation. How easy it is for particles to be left in the common duct which may form the nucleus for recurrent stones, is illustrated in a still more recent case where a large stone in the duct was so crumbling that it broke into fragments and had to be removed by a scoop introduced many times in both directions. After this sterile water was forcibly injected to bring away any particles left behind.

In spite of the fact that the finger introduced into the duct in both directions failed to feel any more particles, a small fragment was later evacuated through the tube.

However, when the gall-bladder has been chronically infected and



its walls altered by inflammatory thickening, it can no longer functionate normally and recurrence of trouble is quite likely. Hence cholecystectomy as a routine procedure, unless there are contraindications, is the safest operation for the future well-being of the patient.

In only two of this series (5 per cent.) was cholecystostomy done and one of these was the only fatal case. The patient was in such poor condition that local anæsthesia was used and the empyematos gall-bladder merely opened and drained of its putrid contents, and a tube sutured into it. After slight improvement another operation was done a month later, again under local anæsthesia. Using a transverse incision, a single stone, wedged into the neck of the gall-bladder and only partly obstructing it, was removed, but the patient shortly succumbed to the cholangitis. This patient had been operated on by cholecystostomy in another hospital nine years before and when she entered Bellevue she was deeply jaundiced and had Charcot's syndrome of chills and fever. With the drainage the jaundice subsided but never entirely disappeared, for, owing to the stone, the drainage of bile was at times insufficient, and at such times she became worse. The head of the pancreas was much enlarged and indurated. A primary cholecystectomy would have avoided all this. In the other case the patient took anæsthesia so badly that a cholecystostomy was done on account of the technical difficulties.

Of course we can lay down no hard and fast rule. The mechanical difficulties as well as the condition of the patient may make cholecystostomy the safer and wiser operation, as in these two cases. With these reservations we now make cholecystectomy the normal procedure in cholelithiasis. It may often be wiser for an inexperienced operator to do a cholecystostomy.

I have seen no particular effect of cholecystectomy unless in two cases a subsequent chronic looseness of the bowels was due to it, attributable perhaps to the more steady discharge of bile into the bowel. It had not been present before.

Mention was made above of a case of congenital absence of the gall-bladder. The fissure of the gall-bladder was present with a smooth surface, save for a few shallow longitudinal fissures. There was no gall-bladder beneath the left lobe and none could be felt within the substance of the liver ("intrahepatic gall-bladder"). Finally, after a careful search, no trace of a cystic duct was found. There were three facetté stones in the common duct, which was opened and drained. The duct was not dilated any more than it would be from the presence of stones. A. Schachner<sup>1</sup> has collected cases of abnormalities of the gall-bladder and gives seven cases of congenital absence.

In two recent cases the gall-bladder was firmly adherent to the first portion of the duodenum in one and to the pyloric end of the stomach in

<sup>1</sup> Schachner, A., *ANNALS OF SURGERY*, May, 1916.

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the other. On freeing these adhesions a perforation into the duodenum was found in the former and in the latter the perforation only extended through the peritoneal coat which was dissected up for a distance of half an inch on all sides of the opening.

Two of these forty cases I have since operated for renal calculi. One had also been cured of a bladder tumor by fulguration and required nephrectomy on account of the condition of the kidney. The other gave a large X-ray shadow which was interpreted as a gall-stone, but on operation it was felt to be in the pelvis of the right kidney, the gall-bladder being filled with small stones. Thirty-two months later five calculi were removed by pyelotomy. The occurrence of renal calculi in these two cases was doubtless merely a coincidence. Another case was found to have double cystic kidney, some symptoms of which were present when the gall-bladder was operated on. No return record has been obtained in this case. In 25 per cent. of this series the appendix was removed at the same time as the gall-bladder, usually through the same incision, on account of a pathological appendix.

In only one case did the X-ray show a shadow of the gall-stones and in a few others the outline of the gall-bladder was distinctly seen. But X-rays were not taken in all cases, as in the routine hospital X-ray work at Bellevue Hospital the X-ray of gall-stones has been of little positive or negative value.

The mortality in this series was 2.5 per cent.

Finally, I add a few details of the operation and the results. I believe in operation on patients with gall-stones when the diagnosis can be made and sometimes to make the diagnosis. There is no such thing as "innocent" or "harmless" gall-stones. They are all capable of harm, and so is the infected condition of the gall-bladder which usually accompanies them, and on which they depend for their formation. Sooner or later the condition is bound to become worse, and there is no medical cure. It is easier and safer to operate in the early stages before the pathological changes in the gall-bladder have become advanced, or the stones have found their way into the ducts, especially the common duct. In this way, too, we will save a few cases of early carcinoma of the gall-bladder.

Most of the cases were operated by a vertical incision over the right rectus. It is easier to remove the gall-bladder if this incision is not far (not more than 1 to 2 inches) from the midline and approaches it at the upper end. The muscle may be split, or more often retracted outward as a whole. The length of the incision depends upon the amount of adipose tissue and the difficulty of the operation. I have used the Sprengel transverse incision in five cases of this series. I have found that it gives a good but no better exposure, in most cases, than the vertical incision. In a few difficult cases I have obtained a better exposure by partly dividing the right rectus at the fibrous intersection opposite the umbilicus.

I do a cholecystectomy if there is no contraindication, as stated above.

I prefer to do this from behind forward after clamping the cystic duct and artery. The latter clamp controls most of the bleeding whether the gall-bladder is removed from behind forwards or *vice versa*. To get at the cystic duct we have to raise up the pouch at the neck of the gall-bladder, and divide a peritoneal fold usually connecting it with the hepato-duodenal ligament. This opens the gastrohepatic omentum and exposes the cystic duct to its junction with the common duct. The bed of the gall-bladder was covered by suture of the lateral flaps of peritoneum to minimize adhesions, whenever it was possible. The common duct was opened for the removal of stones in seven cases, for exploration and drainage in two, in which there was chronic pancreatitis with jaundice. In another case with jaundice from chronic pancreatitis the cystic duct was split up to allow probing of the common duct.

In nearly all cases of cholecystectomy I use a cigarette drain to the stump of the cystic duct. It would be ideal if we could close these wounds without drainage, but in a small percentage bile leakage occurs and requires drainage. The soiling of the peritoneum with bile seems to provoke peritoneal adhesions. The presence of a drain has the same effect around its course, but I believe that a drain for four or five days is of more value on the part of safety than it is harmful from adhesions.

Occasionally I have closed the wound without drainage. The convalescence was smooth or normal in 80 per cent. In two it is not mentioned, in one it was protracted by the breaking down of the wound and in another by local infection, and in one there was quite a large gastric hemorrhage, from a gastro-enterostomy. This was treated by absolute quiet and hypodermoclysis and he made an excellent recovery. Three of the four cases in which stones had recurred after a previous cholecystostomy made a normal convalescence after cholecystectomy, the other was the only fatal case. All of the seven cases of common duct stones made a normal convalescence, as did also the three cases of cholecystectomy where the common duct was drained or probed on account of chronic pancreatitis with jaundice. The drainage of bile varied from ten to twenty-eight days.

Excluding the fatal case, where severe cholangitis was present, the other four cases where pancreatitis was responsible for the jaundice were all treated by cholecystectomy, and all made an uneventful convalescence.

The three who returned reported a perfect result. In only one of these was there marked jaundice at operation. In this case the common duct was opened and drained, as it was in one other case of chronic pancreatitis. In all these cases the gall-bladder was thickened, contracted and adherent, so that there was no object in retaining it for a possible anastomosis with the duodenum, in case the pancreas caused continued obstruction to the flow of bile. In fact, there was all the more reason to remove the gall-bladder to cure the pancreatitis, if it is due to infection from the gall-bladder. In case of deep and persistent jaundice from an in-

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flamed or carcinomatous head of the pancreas it would be wise to save the gall-bladder, if it is normal enough for use in a cholecystenterostomy.

In three cases the inflammation of the gall-bladder was acute enough to account for considerable oedema, especially near its neck. In such cases a cholecystectomy is often easier than usual, and acute inflammation, gangrene or threatened perforation are strong indications for cholecystectomy, provided the patient's condition or the operative difficulties do not contraindicate it. All these three patients made a normal convalescence and recovery.

No return records are recorded in ten cases in spite of the efforts of the return clinic and social service departments. The late result was excellent in 79.3 per cent., satisfactory in 13.8 per cent. One of the latter class, who was markedly improved, still eructates gas occasionally, but was accepted by the draft board. Another, who also had an appendectomy, still has some pain in the right lower abdomen, but had gained 21 pounds. In three of those not showing a perfect result constipation continued to be a marked feature after operation. The two cases classed as unsatisfactory had pain at times, one in the right upper quadrant and one in the lumbar region, though the latter was probably not due to the gall-bladder operation. The return records represent the end-results at periods varying from two months to four and a half years, and average eighteen and two-thirds months.

If the immediate and late results are as good as this in late and complicated cases they should be even better in those operated on early.

## THE PRODUCTION BY CHEMICAL MEANS OF A SPECIFIC CHOLECYSTITIS

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AN ACUTELY inflamed gall-bladder was found in a dog that had been injected intravenously with a solution of chlorinated soda (Dakin's solution). Further investigation showed that this occurred in a high percentage of instances. Many experimental investigations have been made of the condition of cholecystitis, in all of which bacteria have been employed in some manner or other. The present investigation of a chemically produced cholecystitis was carried out, not because of the possibility of its having any direct bearing on the condition as it occurs in man, but because it offered an opportunity to observe the production by a chemical, of an inflammation of a particular organ. Facts have been ascertained with regard to this phenomenon as follows:

*Animals Used.*—The solution was injected into dogs, cats, and rabbits, the most successful experiments were conducted on dogs. While definite gall-bladder changes were produced in a few cats, on the whole, they were not satisfactory animals to work with, because the solution is more toxic to this species. Carrel has noted that the intravenous injection of the chlorinated soda solution in rabbits produces marked toxic action and this was our experience also; thus they were of no value for this investigation.

*Amount of Solution Necessary to Produce the Reaction.*—From 5 to 12 c.c. for each kilogram must be injected. If less than 5 c.c. are injected, the gall-bladder is rarely affected, and if more than 12 c.c. are injected, the general effect of the solution may kill the animal. In most of our experiments from 8 to 10 c.c. were injected.

*Time After Injection Necessary for the Gall-bladder to Be Affected.*—The inflammatory reaction of the gall-bladder seems to occur almost immediately after injection, and is certainly completed within the first twenty-four hours. As a matter of fact, if the gall-bladder of an anæsthetized dog is under observation and an intravenous injection of the solution is made, quite frequently it is possible to see the beginning injection of the blood-vessels, their rupture, and the infiltration of the tissues with blood. Well-marked gall-bladder reactions have been noted in a cat and in dogs within one-half hour after the injection of the solution into the blood-stream.

*Route Taken by the Solution to the Gall-bladder.*—It was at first thought that the chemical producing the reaction was excreted in the bile and thus reached the gall-bladder. This was shown not to be true, however,





FIG. 1.—Drawing of a specimen of a gall-bladder two hours after the injection of chlorinated soda solution. Note the marked acute inflammatory reaction produced.



## CHEMICALLY INDUCED CHOLECYSTITIS

because (1) the time at which the reaction occurs after injection is too short; (2) it is possible to observe the early stages of the reaction, and (3) in some animals the cystic duct was securely ligated and the gall-bladder changes took place after the injection, as when the cystic duct was patent. There can be no doubt that the chemical reaches the gall-bladder through the blood-stream.

*The Chemical Substance Producing the Reaction.*—The exact chemical in the solution which produces the reaction has not been determined definitely. Some of the evidence points to the chlorin. For instance, the solutions in which the available chlorin is less than 0.48 per cent., seldom produce any reaction on the gall-bladder. In several experiments chlorin water was injected. This solution is so toxic, however, that but little of it can be injected intravenously without causing the immediate death of the animal. If such a small amount were injected that the animal lived the gall-bladder was not found to have been affected. If larger amounts were injected, the animal invariably died in a short time. In one or two instances, a medium amount was reached and a few slight changes in the gall-bladder were noted. It would seem from this that the chlorin may be the active chemical agent, but the fact that the number of positive results obtained by different samples of the chlorinated soda solution was variable, seems to indicate that other factors were involved besides the chlorin. For example, with two solutions of practically the same chlorin content, one may give 100 per cent. gall-bladder reactions, while the other produces little or no effect.

*The Involvement of Other Organs by the Solution.*—The injection of the solution, of course, produces effects other than changes in the gall-bladder. Quite often a certain amount of nephritis may occur, and congestion of the liver has been noted. In a few instances, it was noted that the blood-vessels on the surface of the liver were injected in a manner similar to those of the gall-bladder. This was particularly true in cats, in which species these blood-vessels are sometimes quite prominent. None of the other changes appear prominently at necropsy and they certainly do not appear to differ essentially from the changes caused by the injection of some other toxic agents.

The outstanding feature usually noted at necropsy is the inflammation of the gall-bladder, which is not noted after the injection of other substances. For this reason it may be concluded that a specific chemical cholecystitis is produced, although the specific reaction seems to be on the blood-vessels on the surface of the liver and is most marked on the surface of the gall-bladder because that is more vascular.

*Relation of the Blood Supply of the Gall-bladder to the Reaction Occurring After Injection.*—Whether or not the gall-bladder is affected by the solution depends on several factors, one of the most important of which is the blood supply. A gall-bladder that does not have a good blood supply, particularly blood-vessels coming directly from the liver, rarely

has shown changes following injection, while a gall-bladder with a generous supply of blood-vessels from the liver that anastomose over the surface of the viscus has usually shown very marked changes. It has also been observed that gall-bladders of animals not in good condition, as those having distemper, usually develop few or no changes following injection.

*Gross Appearance of the Acutely Inflamed Gall-bladder.*—The gross appearance of the gall-bladder within the first twenty-four hours after the injection of the solution is that of intense inflammation. The lesions start at the fundus of the gall-bladder and on the exposed surface, usually at the point where the blood-vessels arising from the vessels in the liver on each side anastomose. The dilatation of the lymphatics usually is the first change noted after injection. The lymphatics of the gall-bladder become very prominent and are soon colored with the blood contained in them. These lymphatics can readily be traced in their course to the adjacent lymph-nodes. The reaction is not altogether specific for the blood-vessels of the gall-bladder; because the liver is shown to be also affected by the fact that the lymphatics draining the various lobes are somewhat injected, but not to so marked a degree as those of the gall-bladder. A breaking down of the small capillaries follows with a transudation of the contained blood, making minute petechiæ, which may gradually spread and involve the whole surface of the gall-bladder. At first these areas into which the blood has escaped from the vessels are red; changes then take place and most of the areas turn dark green and the entire gall-bladder has a gangrenous appearance. The organ becomes so tense in many instances that rupture seems imminent. There is usually very little, if any, œdema and adhesions to the omentum or other organs rarely form. The reaction seems to localize to a marked degree; seldom it has been seen to extend beyond the gall-bladder and cystic duct. The common and hepatic ducts do not seem to be involved in the reaction.

*Microscopic Appearance of the Acutely Inflamed Gall-bladder.*—The acutely inflamed gall-bladder shows first a marked breaking of the capillaries and infiltration of the wall of the gall-bladder. There are two areas of infiltration; in one the capillaries between the muscle and the serous coats are mainly or wholly affected and blood escapes and infiltrates between these two coats. In the other area the capillaries within the muscle coat are mainly affected, and the infiltration takes place between the bundles of muscle-fibres. At times this infiltration is so extensive that the whole section appears to be a mass of blood. The mucosa has not been found markedly affected primarily. In some cases, however, small hemorrhagic cyst-like areas are produced just under the mucosa; a definite ulceration of the mucosa may later occur, draining the extravasated blood into the gall-bladder.

*Chronicity of the Lesions.*—The reaction of the acutely inflamed gall-bladder may last for several weeks. It has been noted five weeks after

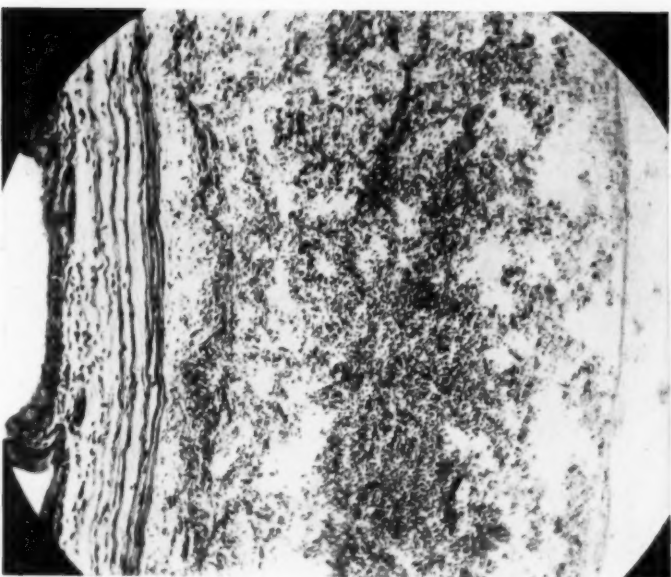


FIG. 2.—Photomicrograph of a section of the wall of the gall-bladder fifty hours after injection. In this case the infiltration of the blood took place between the serosa and the muscularis. This is the usual type of lesion produced.  $\times 100$ .

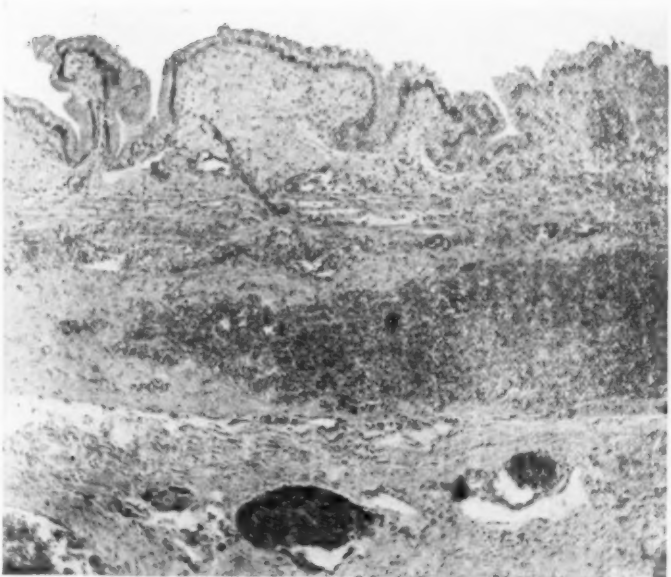


FIG. 3.—Photomicrograph of a section of the wall of the gall-bladder fifty hours after injection. The infiltration of the blood took place in the muscularis.  $\times 70$ .



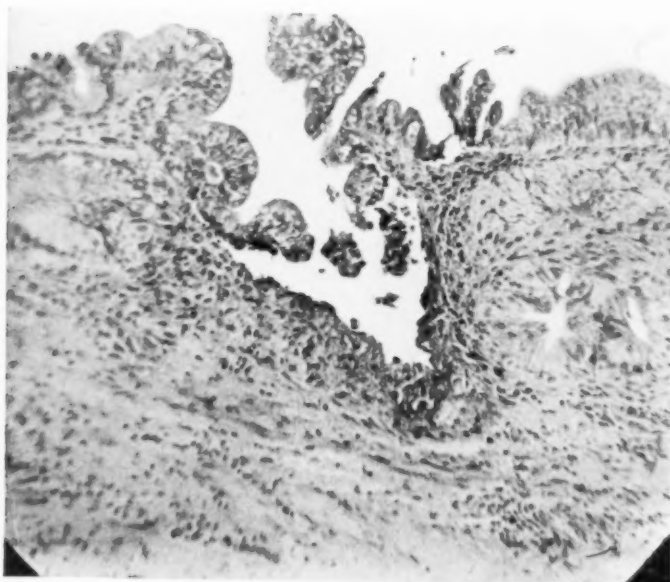


FIG. 4.—Photomicrograph of a section of the wall of the gall-bladder fifty hours after injection. A small ulceration of the mucosa has occurred. The base of the ulcer is infiltrated with blood in a manner similar though to less extent than is shown in Figs. 2 and 3. This type of lesion has rarely been noted.  $\times 100$ .



FIG. 5.—Photomicrograph of a section of the wall of the gall-bladder forty-three days after the production of the acute condition. The organization of the blood which had infiltrated in the muscle-wall is shown.  $\times 50$ .

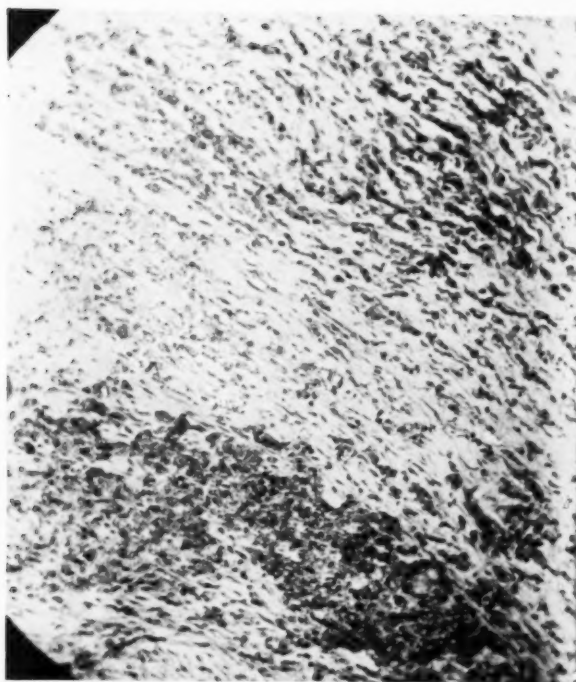


FIG. 6.—A higher magnification of Fig. 5. Note the marked reaction which the intramuscular hemorrhage has produced.  $\times 100$ .



## CHEMICALLY INDUCED CHOLECYSTITIS

injection that the gall-bladder had practically the same appearance as it had twenty-four hours after injection. Gradually the condition clears up, and in three months it may appear normal except for a few small white scars. In some cases, however, the condition becomes chronic. Although it has not been proved definitely, it seems as if the organs which apparently returned to normal were in animals in which the extravasation of blood took place between the serosa and muscle coat, while in those in which a definite chronic condition developed, the blood infiltrated the muscle coat. The end-result of these chronic lesions has not been studied fully.

In several experiments an exploratory operation twenty-four hours after injection showed a definitely inflamed gall-bladder; the animals are still alive and in good condition several months after the production of the acute lesion. It is hoped that these experiments will furnish material for a study of chronic gall-bladder lesions.<sup>1</sup>

### SUMMARY

It has been found that the intravenous injection of a solution of chlorinated soda in dogs produces a definite reaction of the gall-bladder in a high percentage of experiments. The reaction consists of a breaking down of the capillaries and infiltration of the wall of the gall-bladder with blood.

To produce the reaction in the gall-bladder it is necessary to inject relatively large amounts of the solution, at least more than 5 c.c. for each kilogram. The reaction takes place very shortly after the injection, and is completed within the first twelve to twenty-four hours.

The reaction is undoubtedly produced by some chemical in the solution; chlorin is suggested as the probable substance. All solutions, however, even though their chlorin content may be practically the same, do not give the same percentage of gall-bladder reactions; it would thus appear that a factor other than the chlorin content was involved.

The solution reaches the gall-bladder through the blood-stream and a gall-bladder in which the blood supply, particularly that coming from the liver, is generous, develops the most marked reaction. In some instances a definite chronic condition has followed the acute condition.

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Carrel, A., and Dehelly, G.: *Infected Wounds*. New York, Hoeber, 1917, 32.

<sup>1</sup> This observation probably has no bearing on the use of chlorinated soda solution in the treatment of wounds. The amount of such a solution necessary to produce the reaction in the gall-bladder would be so large that it does not seem probable enough could be absorbed from a wound to produce cholecystitis. It seems that the only condition in which a large amount of the solution might be absorbed is the treatment of acute empyema. We have injected quantities (5 c.c. per kilo) of the solution into the thorax of dogs daily for several days without producing a reaction in the gall-bladder. Our work in no way invalidates the legitimate use of the solution. Carrel has emphasized that it is very toxic when injected intravenously.

## HEMORRHAGIC CYSTS OF THE SPLEEN

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AND

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ALTHOUGH splenectomy is no longer an unusual operation, a few splenic anomalies are found which are not common, and which require proper consideration and care in order that the correct pre-operative diagnosis be made; and among these may be mentioned cysts of the spleen.

*Historical.*—The first case of splenic cyst reported was one found at autopsy, by Andral, in 1829. The first extirpation of a cystic spleen was performed by Pean in 1867. In 1891 Terrier performed a partial splenectomy successfully, and five years later Gluck treated a hemorrhagic cyst by incision and drainage. Up to 1908 there were thirty-three recorded cases of operations on cystic spleens, with complete recoveries in twenty-nine cases. Twenty-one additional cases were found post mortem.

*Classification.*—Dermoid cysts of the spleen are extremely rare, and echinococcus cysts are most common of all types. Splenic cysts may be classified as follows: (1) Dermoid cysts. (2) Echinococcus cysts. (3) Simple unilocular or multilocular cysts. a. Serous. b. Hemorrhagic. c. Lymph or chylous cysts.

The incidence is greater among females, about 65 per cent. The two cases herein reported were both in females.

*Etiology.*—Inclusion of peritoneal endothelium in the spleen capsule may soften, degenerate, and liquefy, thus giving rise to cysts. Due to the absence of secretory glands true retention cysts are not possible. Trauma and diseased conditions of the vessel walls cause hemorrhage. The exudate becomes encapsulated, thus giving rise to cysts. Increase in size of a hemorrhagic cyst is due, probably, to repeated hemorrhage into it. Simple cysts may be caused by occlusion of arterioles with subsequent destruction and liquefaction of the pulp.

*Pathology.*—The lymph-cysts are usually multiple and of small size. The hemorrhagic cysts, on the contrary, are usually large and single. Sometimes they are lined with endothelium. They may be located in any part of the organ, but are found most frequently in the anterior portion, low down, in or under the capsule. In some cases the cyst walls are thickened and calcified. Adhesions frequently occur, and these may render operative procedure more difficult. The weight of the cyst may be great enough to produce considerable transposition, a point to be con-



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sidered in diagnosis. In one case the spleen rested on the bony pelvis. The cysts seldom rupture or become infected.

*Symptoms.*—Small cysts seldom cause any symptoms. The larger cysts give rise to symptoms by pressure and traction. Disturbances of function are common, so that there may be a feeling of fulness, and tenderness, also respiratory, digestive, and urinary abnormalities. Pain may be present if there is a perisplenitis, if the organ is transposed, or if there is a sudden increase in the size of the cyst; but otherwise pain is absent or negligible. In its most frequent location (anteriorly) the cyst usually produces an overlying abdominal enlargement. On palpation one finds, as a rule, a fluctuating tumor.

*Diagnosis.*—The diagnosis may be made by one or more of the following procedures: (1) The finding of a fluctuating tumor which is definitely associated with the spleen. In some cases the tumor may not fluctuate; and in others the spleen may be displaced. Sometimes a pronounced friction rub may be heard. (2) Aspiration. Examination of the aspirated fluid may be sufficient to establish a diagnosis. Puncture should be made at the bottom of the cyst so that hydatid cyst may be differentiated. In the latter case, however, other evidence of echinococcus disease may usually be found. The fluid may be of low specific gravity, clear, with very little, if any, albumin, and not very cellular. Such a fluid is indicative of a serous cyst. In lymph-cysts the fluid will be of high specific gravity, with a large amount of albumin, and it may clot. In hydatid cysts one usually finds scolices, hooklets, or bits of lamellated membrane. Hemorrhagic cysts are, of course, evident by their bloody contents. (3) Sometimes nothing but an exploratory laparotomy will reveal the true nature of the lesion.

It is necessary to differentiate splenic cysts from cysts of the kidney, ovary, liver, and pancreas, hydronephrosis, true neoplasms, and inflammatory overgrowths in the upper left quadrant. A pre-operative diagnosis has rarely been made.

*Treatment.*—Bircher gives the following results of operation in thirty-three cases: (1) Puncture (by cautery)—6 cases, 2 deaths. (2) Incision and drainage—9 cases, 1 death (sepsis). (3) Resection of cyst—4 cases, 1 death. (4) Splenectomy—15 cases, no deaths.

It is seen that splenectomy is the most advisable operative procedure. Sometimes, however, dense perisplenic adhesions render splenectomy a most difficult and dangerous operation, wherefore incision and drainage is resorted to.

The following two cases of hemorrhagic cysts are reported.

*CASE I.*—H. M., aged twelve years. Admitted to Mt. Carmel Hospital May, 1907. The family history is negative. Complaint, tumor in the left side.

*Personal History.*—A few months after the child's birth the parents noticed a nodular swelling in the left side. This gradually

increased in size and was still growing at the time of admission to the hospital. The size of the growth has, of late, interfered with normal bodily movements.

*Physical Examination.*—A well-nourished female child who presents no abnormality except a well-defined swelling in and below the left hypochondrium. The swelling is firm, insensitive on ordinary pressure, and comes from under the left costal cartilages, at the same time moderately elevating them and the adjacent ribs. The tumor is apparently of the size of a grapefruit, takes its origin in the region of the spleen, and does not fill the loin after the manner of a renal enlargement. There is dulness over the tumor and the lower thorax in an area as large as the palm of one's hand. The urine is normal. There is no alteration of the blood other than a mild secondary anæmia. A diagnosis of splenic tumor was made, although cyst was not suspected.

*Operation.*—Through an incision in the left rectus muscle the tumor was exposed, and its nature was at once apparent. A thick-walled cyst as large as a fist occupied the lower pole of the spleen which above this point was moderately enlarged, and of firmer consistency than normal. The fluid in the cyst was opaque, brownish in color, with a slight greenish tinge. There were only unimportant adhesions, and removal was accomplished without especial difficulty. Recovery was rapid and uncomplicated, and the patient is now in perfect health, thirteen years after operation. The cyst had destroyed a bulk of splenic tissue equal to one-fourth of the normal organ, but the spleen above was increased in size by much more than that.

*Diagnosis.*—Hemorrhagic cyst of the spleen.

*NOTE.*—The hospital record of this case was lost during the flood of 1913, and the above history was reconstructed.

*CASE II.*—Miss S. R., aged twelve years, was admitted to Mt. Carmel Hospital on July 10, 1919. Service of Dr. C. S. Hamilton. Family history negative. Complaint, pain in left epigastrium.

*Personal History.*—Patient has had the usual diseases of childhood, but otherwise has been in fairly good health. Four years ago she fell against a wooden step, injuring herself in the epigastrium. She felt sick for a few days. There was no swelling noticed at the time. Five months ago she was again injured in a similar manner, which necessitated her staying in bed for several days.

*Present Illness.*—Patient first noticed a swelling seven months ago, about the size of an egg. This disappeared in two months, but after her last injury the swelling reappeared and grew rapidly. The tumor is not painful and apparently does not interfere with heart or respiration. The patient appears less energetic than formerly, and has lost three pounds in weight. Appetite good.

*Physical Examination.*—Heart loud, irregular sounds, misses every sixth or seventh beat. Lungs normal. Abdomen, soft mass in left hypochondrium. Feels cystic. It is bounded by a line starting at the ensiform cartilage and passing around the left costal

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margin to the end of the eleventh rib, and then to a point midway between the umbilicus and the ensiform. Its transverse diameter is 7 inches. Longitudinal diameter 6 inches. It is raised above the surrounding abdominal wall about  $1\frac{1}{2}$  inches. It moves with respiration. It does not extend to the back. It extends under the ribs and raises them. There is fluctuation. It is not tender to palpation.

*Laboratory Report.*—Urine normal. Blood: reds, 4,102,000. Leucocytes, 10,000. Polynuclears, 62 per cent. The blood picture is that of a very mild secondary anæmia.

*Operative Notes.*—A tense fluctuating tumor, not especially sensitive, projects strongly in the left epigastrium to a point slightly beyond the median line, as low down as the navel, and lifting markedly the sixth, seventh, eighth, and ninth ribs in front, with dulness extending backward on these ribs slightly beyond the posterior axillary line. Long incision in the left rectus muscle with a slight prolongation along the margin of the ribs toward the median line. The tumor, which is a cyst of the spleen, is covered with adhesions of omentum, which must be released. There are also adhesions to the diaphragm which are divided between ligatures. The cyst is then opened, and discharges a coffee-colored fluid which is evidently altered blood. The removal of the spleen is then easily accomplished, ligating the pedicle in four or five places, avoiding the pancreas and stomach without difficulty. The bed of the spleen shows some disposition to bleed, therefore a hot towel pack is applied, and removed at the end of suturing. A good-sized tube drain is inserted. The patient made an uninterrupted recovery, and left the hospital two weeks later.

*Pathological Report.*—The original mass measures 15 x 15 x 8 cm. It has been incised. The outer lower third is of normal appearance and consistency. The remaining portion is of mottled appearance, and is covered with adhesions. On section one finds a single large cyst, with a roughened fibrous wall. The wall varies in thickness from  $\frac{1}{2}$  to 4 mm., and is lined with an intricate network of anastomosing blood-vessels.

*Microscopic Appearance.*—The serous covering is of normal appearance. The thickened capsule is composed of elastic fibres, smooth muscle-cells, and connective tissue. A few areas present degenerative changes of a hyalin nature. There is a moderate diffuse hemorrhagic infiltration, and occasionally one finds patches of modified blood pigment. In some of these pigmented areas are occasional foreign-body giant-cells. Capillaries and small vessels are distributed throughout the capsule. A mild diffuse infiltration of lymphoid cells and occasional pus-cells occurs. At a few points there are small amounts of pulp tissue attached to the cyst wall. The walls of the arteries in the pulp are abnormally thick. The Malpighian bodies are not numerous, but are of normal size and appearance. That portion of the spleen which was not involved in the cystic process is of normal appearance.

The fluid from the cyst measures 620 c.c. in volume. It resembles in appearance black coffee. Its specific gravity is 1022. Microscopically one finds nothing but red blood-cells, mostly in rouleaux formation, and a few white blood-vessels.

*Diagnosis.*—Simple hemorrhagic cyst of the spleen.

## POLYCYSTIC KIDNEYS AND LIVER\*

By DANIEL N. EISENDRATH, M.D.

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PATHOLOGISTS are familiar with the various congenital anomalies of the abdominal viscera, through autopsy findings. Until recently the clinician was of the opinion that these variations from the normal in the form, location, and structure of abdominal viscera as the result of errors in development were not of any importance in the consideration of the diagnosis of a given clinical picture in the living. Frequent mistakes, however, in this direction have emphasized the necessity of a thorough acquaintance with every possible congenital anomaly in order to avoid some of the pitfalls of diagnosis. This is especially true of the results of developmental changes in the urinary tract.

One of the most instructive examples in which the persistence of embryonic defects gives rise to a series of puzzling clinical pictures is seen in the condition commonly called polycystic kidney. In these cases the kidneys are converted into a series of cysts of varying size (Fig. 1). The most generally accepted theory as to the origin of the condition is that of Berner,<sup>1</sup> namely, the tubules which arise from the Wolffian duct in the embryo fail to unite with those of the glomerular system. I have recently<sup>2</sup> discussed the entire subject from the clinical standpoint and would refer those who are interested to this article. Both kidneys are involved at some time or other in nearly 85 per cent. of the cases,<sup>3</sup> so that although nephrectomy is performed on the most involved side, life is not greatly prolonged as the opposite kidney continues to undergo the same changes. The disease occurs in the embryo and again after middle age (forty to fifty years), the latter form the majority.

In 18 per cent. of the cases a similar condition is found in the liver. As in the kidney, the parenchyma is gradually pushed aside or replaced by cysts varying in size from a pinhead to the size of an adult head.

The clinical pictures which the condition most frequently presents are the following:

1. Symptoms of renal insufficiency, that is, uræmia of varying intensity according to the amount of kidney tissue not involved;
2. Hæmaturia as the principal symptom. This also varies greatly and may be very severe and constant or of less amount and intermittent;
3. The presence of a unilateral or bilateral abdominal tumor, which

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<sup>1</sup> Virchow, Archiv, 211, 265, 1913.

<sup>2</sup> Surg. Clinics of Chicago, 3, 1057, Oct., 1919.

<sup>3</sup> Luzzato: Degen. Cistica dei Reni, Venise, 1900.

## POLYCYSTIC KIDNEYS AND LIVER

can usually be differentiated from an intraperitoneal tumor by the changes in pelvic outline as shown in a pyelogram;

4. Pain of a dull, aching character as the result of increased intrarenal tension. The pain is never severe unless infection or hæmaturia supervenes.

Fever is not present, as a rule, unless infection complicates the cystic condition. That the symptoms of renal infection may predominate and thus obscure the real underlying disease is not as generally known as it deserves to be. The following case is an example of this rather unusual condition.

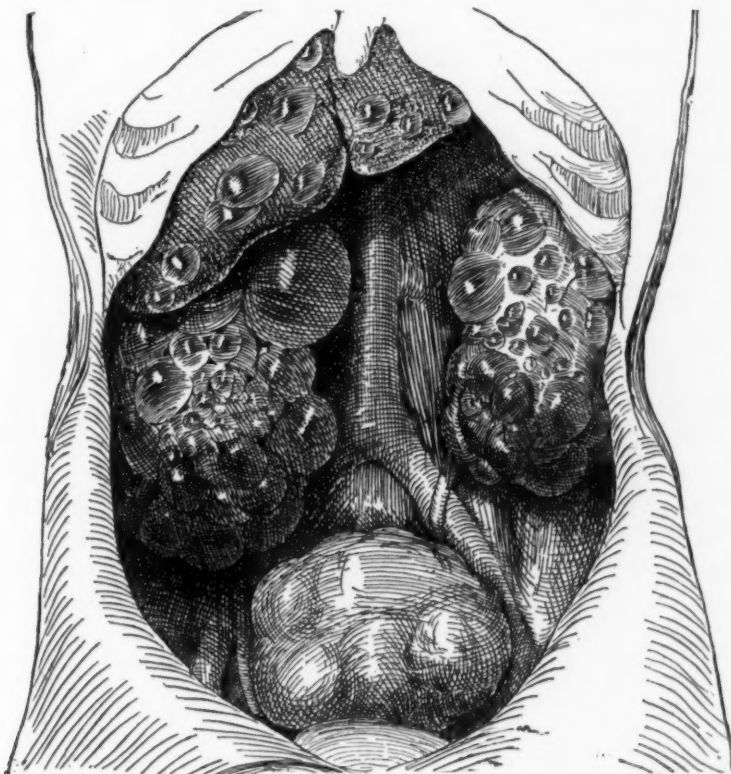


FIG. 1.—Conditions found at operation in case of a congenital cystic liver with bilateral congenital cystic kidneys. The lobulated tumor filling the true pelvis was a fibroid of the uterus.

A woman aged forty-four years was admitted to my service at the County Hospital with a history of sharp pains in the right upper quadrant of the abdomen for the preceding six months. The attacks would recur about once a week and last from four to five hours. She was perfectly well in the intervals. Nine days before admission during an attack of similar pain she had a severe chill and rise of temperature to 104° F., followed in the next thirty-six hours by two similar cycles. A prominence was noticed by the patient in the gall-bladder region soon after the onset of the present attack.



There were no disturbances of urination. The pain remained localized to the right upper quadrant and did not radiate.

Examination of the abdomen revealed a tender prominence just below the costal arch (Fig. 1) extending downwards from the liver and inwards almost to the median line. The diagnosis rested between a hydrops of the gall-bladder with cholelithiasis and a hydronephrosis.

Cystoscopy gave negative results and catheterization of the right ureter for the purpose of pyelography was impossible on account of the presence of a large uterine fibroid which completely filled the true pelvis. The urine showed the presence of a number of pus cells.

An exploratory right rectus incision was made and revealed the presence of multiple cysts (Fig. 1) varying in size from a pea to a walnut, scattered over the surfaces of both lobes of the liver as high up as the diaphragm. The gall-bladder was normal. Both kidneys were the seat of innumerable similar cysts. One of these, the size of a hen's egg, projected directly downwards beneath the right lobe of the liver and thus simulated a distended gall-bladder.

The right kidney was almost twice the size of the left one, but both showed an advanced polycystic condition.

My chief object in presenting this case is that (a) one seldom encounters the combination of polycystic liver and kidneys during life. The frequency of such an association based upon autopsy findings is only 18 to 19 per cent.; (b) the unusual clinical picture. The symptoms of renal infection predominated to such an extent as to completely mislead us.

Even inflation of the colon would have been of no assistance, since this structure did not lie in front but to the inner side of the tumor. Pyelography might have been of some diagnostic aid, but was impossible.

## RENAL TUBERCULOSIS IN TWINS\*

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THE two cases about to be reported have several points of interest that merit placing them on record. These points are: (1) The occurrence of renal tuberculosis in twin girls. (2) The youth of the patients. (3) In one of the cases a bilateral process was demonstrated. (4) The demonstration of extensive calcification in renal tuberculosis in young individuals. (5) Calcifications in the bilateral case occurred in the right kidney. (6) In the unilateral case the right kidney was involved and it showed extensive calcification.

### OCCURRENCE

With reference to the occurrence of renal tuberculosis, it is generally stated to be a disease of adult life. The occurrence of this disease in childhood is not very common, at least, judging by published statistics. It may be possible that it occurs more commonly than is evident, on account of being overlooked or not recognized. Close study of a large series of cases seems to bear out the general clinical impression that this disease is rare in infancy and childhood.

Braasch has recently reported a series of 532 cases of renal tuberculosis. Two patients were under ten years of age (0.4 per cent.) and 37 cases occurred in patients in the second decade of life (6.9 per cent.). Wildbolz, in his series of 245 cases, reported 17 cases in the second decade. Heubner, in his "Lehrbuch," states that he has seen but few cases of the disease in children. Viguard and Thévenat have collected a series of thirty-eight cases of renal tuberculosis in children and found the following distribution with reference to age: Up to four and one-half years, 4; from three to five and one-half years, 8; from six to ten and one-half years, 9; from eleven to sixteen years, 17.

Leedham-Green believes that instead of regarding renal tuberculosis as a relatively rare disease which, when present, is difficult to alleviate and hopelessly incurable, we should now consider it as exceedingly common. His statements, however, do not seem to be verified by the above-quoted statistics.

Kapsammer, in his series of sixty-two cases of renal tuberculosis, reported five cases in the second decade. One of these was fifteen, two were nineteen, and two were twenty years old. One of his cases was bilateral.

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\* Cases reported before the Chicago Urological Society, February 4, 1920.

CASE I.—Lenore P., aged fourteen years. Referred by Dr. Harry Bell. Admitted to the Presbyterian Hospital September 20, 1919.

*Previous Illnesses.*—Patient states she has had measles, smallpox, whooping cough, and several attacks of tonsillitis.

Menstruation began at the age of twelve and was regular until onset of present trouble. Since then, periods have been delayed one or two weeks.

*Family History.*—Father, aged forty-seven years, living and well. During his childhood he suffered from *white swelling of the left knee*, as a result of which the lower extremity is very short and atrophic. Mother, aged thirty-six years, has recurring attacks of cystitis. An aunt and an uncle both have healed pulmonary tuberculosis. A twin sister, whose history is given below (Case II), has a complaint similar to that of the patient.

*Present Illness.*—This began in February, 1919, with painful urination, which gradually grew worse until July, 1919. Pain boring and burning in character; present during urination. In July patient states she became so ill that she could not walk because of pain in the bladder region. This pain was dull in character, similar to pain on urination; relieved when sitting or lying down; aggravated by motion or exercise. At night it was necessary for her to lie on her back to be comfortable. In August, 1919, she had two attacks of hæmaturia on two consecutive nights. No premonitory symptoms preceded the hemorrhages. Attacks of bleeding have always been at night; two attacks of hæmaturia since August. In February, 1919, she began to get up once a night to void. Continued to get up only once at night until August, 1919, when urination was more frequent at night. At times, some hesitation in starting the urinary stream; sometimes the stream would suddenly stop and then start again. No pain in the region of the kidneys.

Patient stated that she had always been outdoors a great deal and slept outdoors winter and summer.

*Physical Examination.*—A well-nourished girl, with a slight pallor. Pupils equal and react to light and accommodation. Slight nystagmus. Esophoria of right eye. Teeth well kept; signs of much repair. Tonsils moderately enlarged. Bean-sized hard glands present at anterior border of left sternocleidomastoid muscle. Lungs show normal expansion and borders; normal vesical murmurs; no râles. Heart borders normal; tones clear; no murmurs; rate, 120. Abdomen negative except for some slight rigidity of the abdominal muscles. Some tenderness in the bladder region. Kidneys not palpable. No changes noted in the spine. Patellar, ankle, triceps and humeri reflexes, normally active.

*Blood Examination.*—Erythrocytes, 4,340,000; leucocytes, 7200; hæmoglobin, 85 per cent.

*Urinalysis* (September 20, 1920).—Alkaline; pale, straw-like in color; trace of albumin; sugar and blood negative. Many leucocytes; a few calcium oxalate crystals and amorphous phosphates.

## RENAL TUBERCULOSIS IN TWINS

*X-ray Examination—Chest.*—For the most part the chest was quite clear. Two small dense nodules noted a short distance from left hilum; right hilum rather heavy, especially in descending branch. No signs of active pulmonary tuberculosis. *Genito-urinary Tract.*—Presence of four large shadows in the region of right kidney (Fig. 1). The three larger shadows showed a dense margin, the centres being lighter and of more or less irregular density. The fourth, or lower shadow, did not have so dense a margin as did the three upper shadows. Left kidney, ureters and bladder, negative.

*Cystoscopic Examination* (September 22, 1919).—Bladder capacity, 35 c.c. Very severe generalized cystitis with many areas of ulceration. Several large areas of ulceration in apex of bladder and large flakes of pus adhering to the bladder wall. A few small areas of ulceration noted around the left ureteral orifice. Both ureters were catheterized without difficulty or obstruction. Examination of the urine obtained upon catheterization showed the following:

TABLE I.

	Bladder	Right Ureter	Left Ureter
Leucocytes per cu. mm.....	1290	450	2400 (bloody).
Cultures.....	B. Coli	Sterile	Sterile.
Stain for T. B.....	T. B. present	T. B. present	None found.
Guinea-pig inoculation.....	.....	T. B. present	T. B. present.

The two pigs injected with urine from the right and left ureters showed, at autopsy, the presence of tuberculous nodules in the spleen and tuberculous abscesses in the groin at the site of injection.

An intravenous phenolsulphonephthalein test was made:

TABLE II.

	Right	Left
Time of appearance.....	7 minutes	6 minutes.
Output first 30 minutes.....	27 per cent.	31 per cent.
Output second 30 minutes.....	6 per cent.	15 per cent.
Total.....	33 per cent.	46 per cent.

As a result of the guinea-pig test, a diagnosis of bilateral renal tuberculosis was made.

A second cystoscopic examination made on October 17, 1919, showed essentially the same cystoscopic picture as at the first examination.

Because of the presence of a bilateral renal tuberculosis, it was decided not to institute any operative procedure.\*

CASE II.—Lucille P., aged fourteen years. Entered Presbyterian Hospital September 20, 1919. Patient is twin sister of patient whose history is given above.

\* A recent communication from the patient's family states that patient died six months after dismissal from hospital.

HERMAN L. KRETSCHMER

*Previous Illnesses.*—Patient has had measles and whooping cough. Menstrual periods began at the age of twelve and have been regular since the age of thirteen.

*Present Illness.*—This began about twenty months prior to admission to hospital, at which time patient was obliged to urinate twice or three times at night. Frequency of urination has been present since onset of trouble. At times there is an increased frequency,

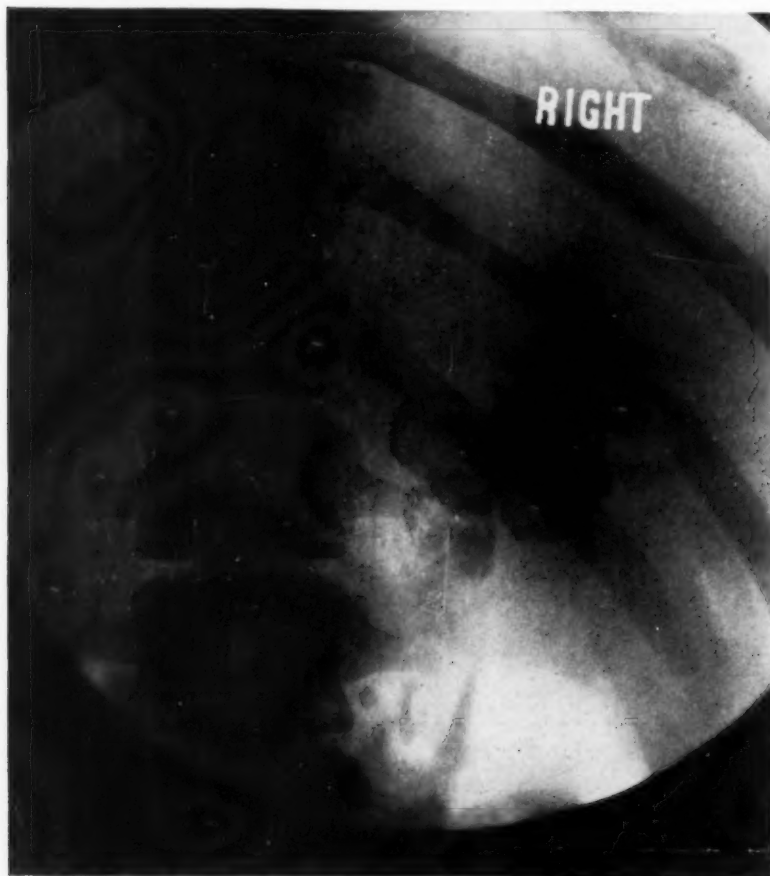


FIG. 1.—Lenore P. Showing the presence of extensive calcification in the right kidney in case of bilateral renal tuberculosis

so that patient voids as often as five times at night. Frequency is less in warm weather and aggravated by exposure to wet and cold. Patient has had twelve attacks of hæmaturia: these lasted from twelve to twenty-four hours. Attacks of hæmaturia have been brought on by exercise or excitement, and, as a rule, they cease during the night and the patient feels relieved by bleeding. Some pain, described as dull or an ache, and soreness in the region of the bladder, aggravated by walking, bending, or standing, and relieved by sitting or lying down. During the attacks of hæmaturia pain is



## RENAL TUBERCULOSIS IN TWINS

absent; intense, on the other hand, when the bladder is completely empty or fully distended. A small amount of urinary dribbling. This has not been constant.

*Physical Examination.*—Pupils equal. React to light and accommodation. No nystagmus or ocular deviation. Nares patent. No marked septal deviation. Teeth well kept; dental repair. Tongue pink, smooth, and not trembling. Pharynx pink. Tonsils moderately large and cryptic. No palpable adenopathy or rigidity of neck. Thyroid gland of normal size. Lung expansion symmetrical and good; resonance normal; borders normal; vesicular murmur

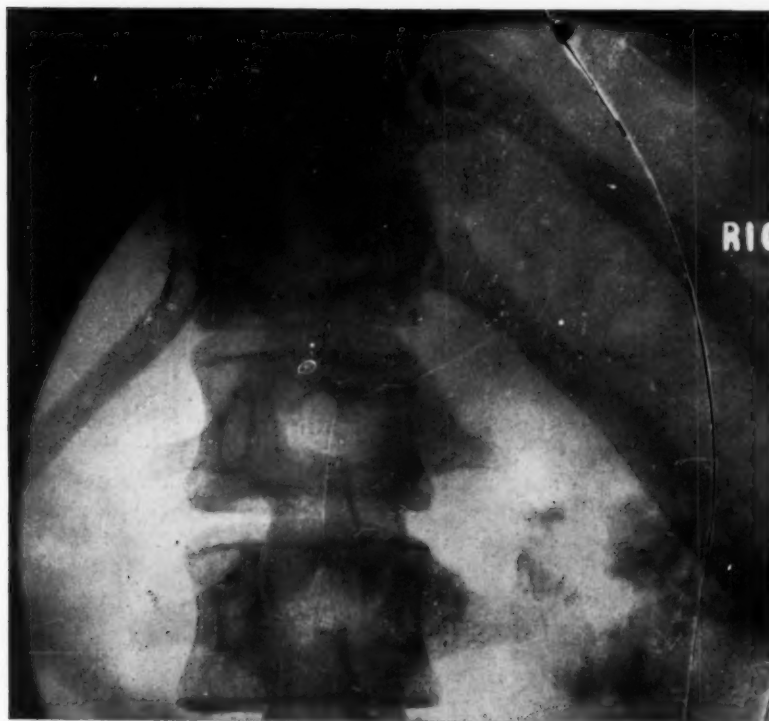


FIG. 2.—Lucille P. Showing the presence of calcification in the region of the right kidney. Not as extensive as was the calcification in Case I.

not altered and no râles. Heart borders normal; tones clear; rate, 110. Slight amount of rigidity of abdominal muscles; no areas of tenderness. Right kidney palpable. Slight amount of tenderness over the bladder upon percussion.

*Examination of Blood.*—Erythrocytes, 4,900,000; leucocytes, 6200; hæmoglobin, 85 per cent.

*Urinalysis* (September 21, 1919).—Acid; trace of albumin; sugar and blood negative. No casts; many epithelial cells and leucocytes; few amorphous urates.

*Röntgen-ray Examination—Chest.*—Moderate hilum densities with slightly increased density along bronchi, extending rather uniformly

fairly well out toward the periphery. In the upper left lung several small, dense nodules, extending outward and upward from the hilum, suggestive of an old tuberculous process. No signs of active pulmonary tuberculosis. *Genito-urinary Tract.*—Negative for the presence of calculi. In the region of right kidney a collection of shadows which extended from the transverse process of the second lumbar vertebra to the upper border of the last rib, and from the lower border of the first lumbar vertebra to the lower border of the second lumbar vertebra (Fig. 2). Shadows irregular in density. Well-defined borders of shadows seen in Case I absent.

*Cystoscopic Examination.*—Bladder capacity very limited. Several large areas of ulceration in apex of bladder. Left ureteral orifice normal; right ureteral orifice retracted and dilated (golf-hole ureter). Many large flakes of pus adhering to the bladder wall. Left ureter catheterized without difficulty or obstruction. Four catheters used in attempt to catheterize right ureter. All catheters passed up the ureter for about 2 cm., beyond which point it was impossible to pass catheters, hence no urine from the right ureter could be obtained. Examination of the urine showed the following:

TABLE III.

	Bladder	Right Ureter	Left Ureter
Leucocytes per cu. mm.....	1750	No specimen	1200
Cultures.....	B. Coli	.....	B. Coli.
Stain for T. B.....	T. B. present	.....	None found.

A second cystoscopic examination was made on October 10, 1919. Cystoscopic findings at this time were practically the same as at the previous examination. The left ureter was catheterized without difficulty or obstruction. It was impossible to catheterize the right ureter because of an obstruction 2 cm. above the ureteral opening. Examination of the catheterized urine showed the following:

TABLE IV.

	Bladder	Right Ureter	Left Ureter
Leucocytes per cu. mm.....	1,000,000 or more cells	No specimen	126
Cultures.....	Staphylococci	.....	Sterile.
Stain for T. B.....	T. B. present	.....	None found.
Guinea-pig inoculation.....	T. B. present	.....	Negative.

The pig injected with the urine from the bladder showed the presence of a tuberculous abscess in the groin at the site of injection and the presence of large tuberculous nodules in the spleen; the pig injected with the urine from the left kidney was negative for the presence of tubercle bacilli.

*Operation* (November 6, 1919).—Under ether anæsthesia the usual oblique lumbar incision was made and a right nephrectomy per-

## RENAL TUBERCULOSIS IN TWINS

formed. Patient made an uneventful recovery. Fissure closed in three weeks. Following the operation there was a rapid improvement in the urinary symptoms and at the present time, patient is free of bladder distress.

The amount of calcification in both cases was rather extensive as evidenced by the Röntgen plates. In other cases of renal tuberculosis, which röntgenologically showed evidence of calcification, the shadows seen were very much smaller than in either of the cases above mentioned.

For several years past, all cases of suspected renal tuberculosis, as well as assured cases, have been radiographed as a routine. It is surprising how often areas of calcification in the kidney region are found; hence Röntgen-ray examinations are dependable in giving additional information which in certain circumstances is not only helpful but desirable.

There are cases in which, by reason of extensive tuberculosis of the bladder, cystoscopy can be carried out only with difficulty and in which the success of ureteral catheterization is questionable. In these cases it is impossible to establish with surety the location of the tuberculous process in the right or left kidney. Hence, if by an uncomplicated procedure, such as röntgenography, the question of right- or left-sided renal tuberculosis may be readily settled, there can be no doubt that we have a simple, easy, and painless method at our disposal.

But this procedure is not unaccompanied by the possibility of a grave source of error—namely, the overlooking of a possible tuberculosis in the opposite kidney. In Case I, reported above, this error would have been committed had we been satisfied with the Röntgen plates and the demonstration of tubercle bacilli in the urine. As a result, a diagnosis of right-sided renal tuberculosis would have been made. Therefore, even though the Röntgen-ray examination, when positive, gives valuable information, it should not be wholly depended upon to the exclusion of ureteral catheterization; for despite the fact that the opposite side does not show calcification, it is *not proof positive* that renal tuberculosis may not be present. This was the status in Case I.

## THE TECHNIC OF THE OPERATIVE TREATMENT OF NEOPLASMS OF THE URINARY BLADDER\*

BY EDWIN BEER, M.D.  
OF NEW YORK, N. Y.

THE treatment of growths of the bladder has been for many years one of the problems of the profession, and it is only recently that a certain uniformity in therapy is beginning to prevail. Prior to 1910 it was generally recognized that a patient suffering from this ailment had a hard road to travel, as operative removal of the growth was so very frequently followed by recurrence of the old trouble. With the introduction of the method of high frequency cauterization through an ordinary catheterizing cystoscope, it is fair to say that a great change has been effected in the treatment of these previously so difficult cases. It was evident, however, from the start, that though this new method was very effective in the treatment of benign papilloma, in malignant tumors it had no field. Moreover, it soon became manifest that even in benign growths of the papillary type there were certain limitations to its usefulness. I have repeatedly emphasized these points during the past ten years, and have urged the profession not to employ this electrical cauterization for the cure of malignant growths as well as in benign growths (*a*) that are not readily accessible; (*b*) that surround the sphincter and bleed so that a thorough treatment is impossible; (*c*) that are so numerous that the bladder is studded with tumors (papillomatosis); (*d*) those cases that for one reason or another are intolerant and can not be regularly cystoscoped. The treatment of these five groups has constituted the modern problem as it presents itself to us to-day. And during these last ten years I have given it my earnest attention with the hope of evolving a surgical technic that would prove more successful than the older methods. It is a description of this technic that I wish to present to the Society to-night, as I am convinced that it marks a distinct advance in the surgery of this condition.

The more carefully one studies the results of surgery of bladder neoplasms, the more evident it becomes that the successful treatment depends upon the avoidance of tumor-cell implants, for recurrences, except in the infiltrating malignancies where they may be due to incomplete operations, are usually due to such implants. Consequently it is necessary in working out a technic for these cases to keep this constantly in mind, and every step of the operation must be so worked out as to avoid implanting tumor-cells on raw or cut surfaces. The successful treatment of papillary growths, benign and malign, is, strange to say, a better test of a method of treatment than the treatment of infiltrating carcinomata, as in the latter it is always difficult to determine whether one has removed

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\* Read before the New York Surgical Society, October 27, 1920.

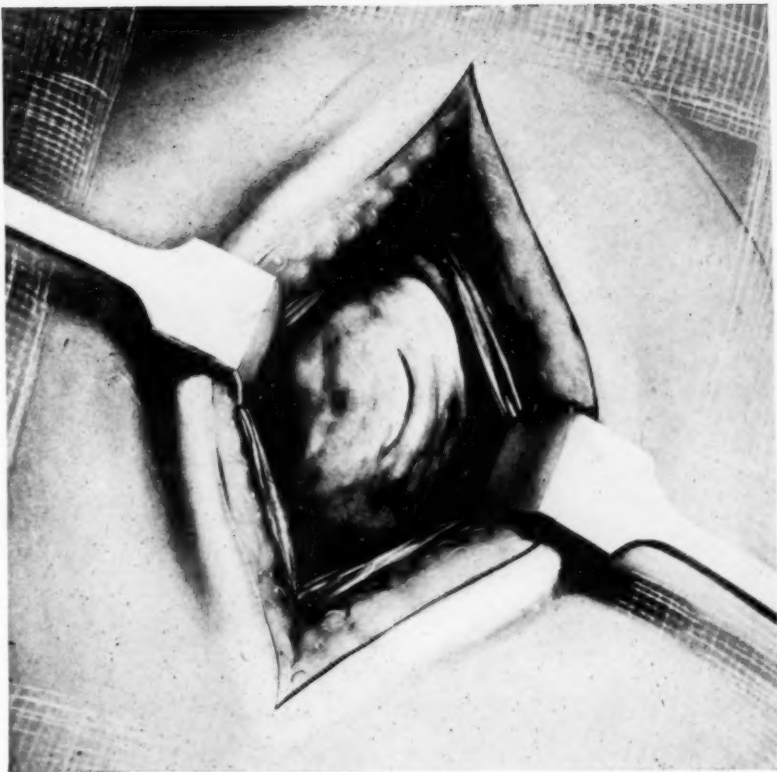


FIG. 1.—Wide extraperitoneal suprapubic exposure of bladder in moderate Trendelenburg position after irrigation and emptying of organ.

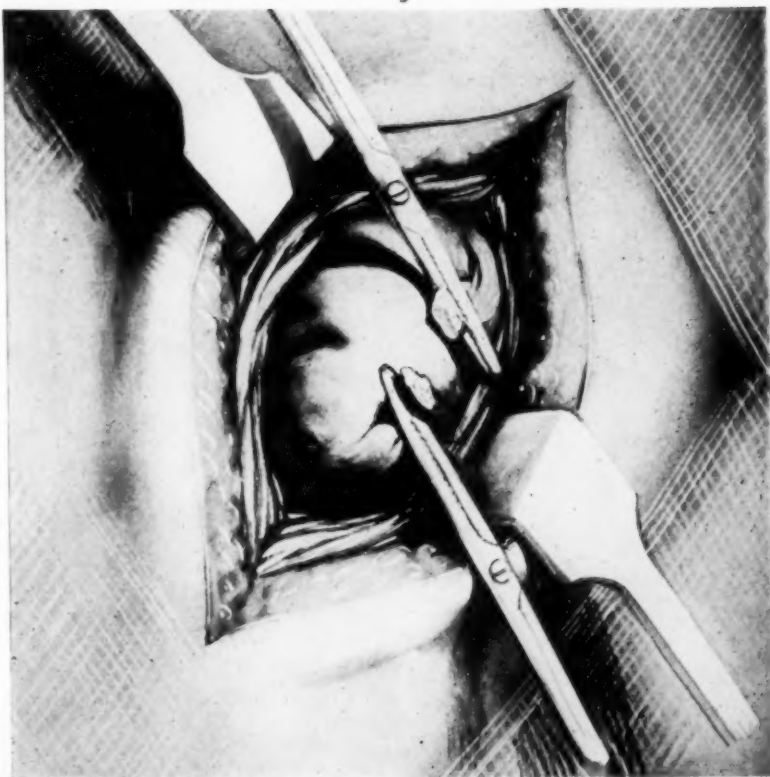


FIG. 2.—Liberation of bladder from its bed. Division of urachus. Bladder pulled out of abdomen.





FIG. 3.—Bladder completely freed by sponging off peritoneum and perivesical nonadherent fat. Posterior surface of bladder presenting as apex is drawn over pubes.

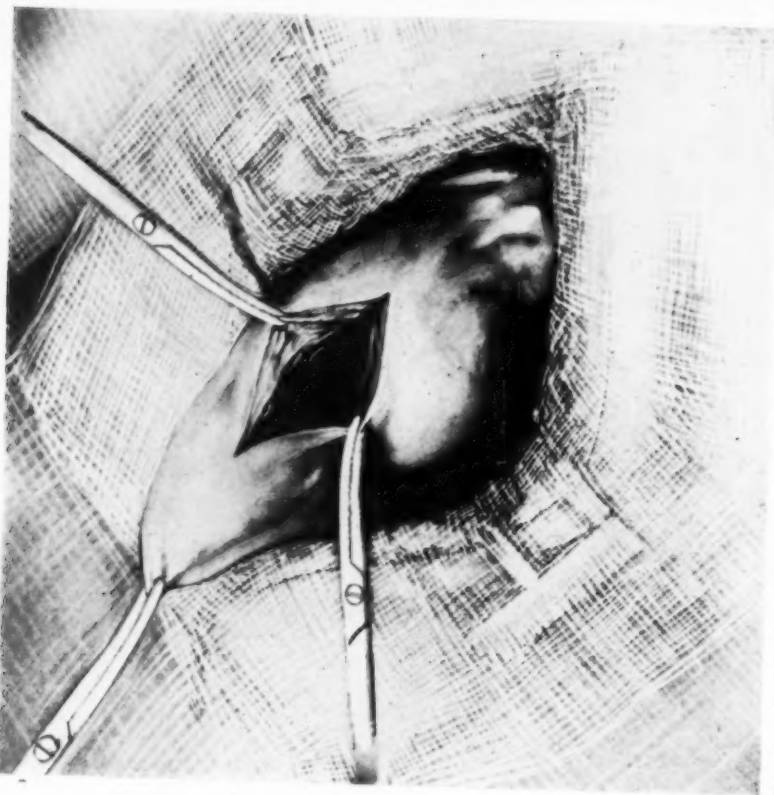


FIG. 4.—Heavy gauze pads surround the bladder and carefully protect all parts of the wound. Incision through posterior wall of bladder. Edges of incision seized with curved blunt forceps. (Carmalt type.)

## OPERATIVE TREATMENT OF BLADDER NEOPLASMS

all the cancerous or tumor tissue or not, while in the former such difficulties are much less frequent. The cure of cases of papillomatosis speaks well for a surgical procedure, and is an excellent test of such a procedure, while recurrences speak against such a procedure. The cure of infiltrating carcinomata may speak well for a method of operating, though usually a large element of good luck enters, while a recurrence in view of the difficulty of deciding the microscopic progression of the disease does not necessarily condemn such a method.

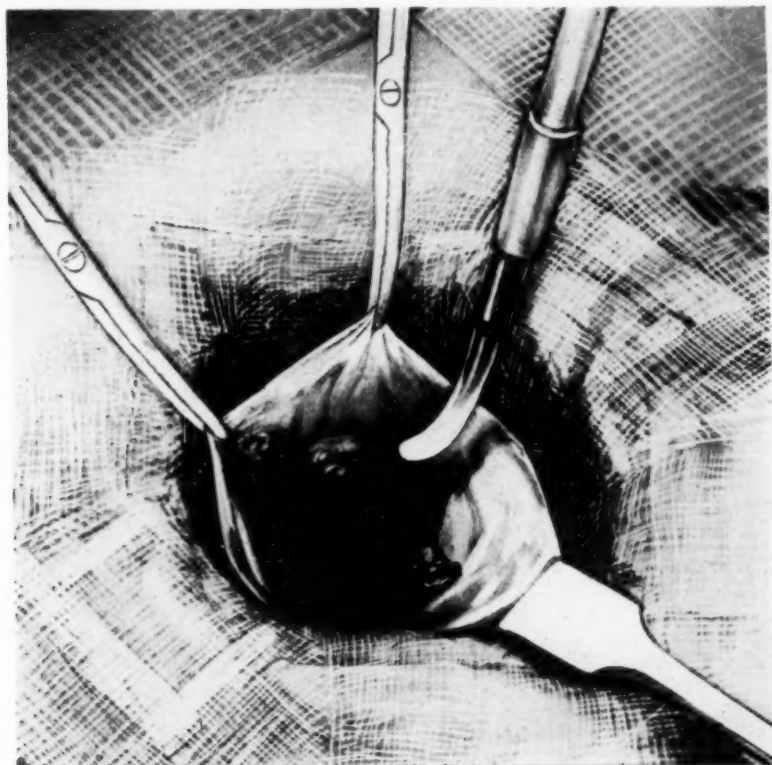


FIG. 5.—The incision in the bladder has been gradually enlarged exposing numerous papillary tumors. With the cautery they are burnt to a crisp and their bases destroyed. (See text for resections and ureter implantations.)

To avoid implants has been the main aim in working out the method to be described. Even under the older methods when less attention was given to this side of our problem, occasional operative cures were scored, but with our minds alert to the frequency of implants and doing everything now to avoid them, our results have improved to such an extent in the non-infiltrating neoplasms that I feel inclined to aver that the operative results are nearly as good, if not as good, as those obtained in suitable cases with the transurethral method, and in view of the fact that these cases are the most difficult, this speaks very well for the operation which I am going to describe.

The technic briefly is as follows. With the illustrations I believe I can make many of the points clearer.

1. The bladder is gently irrigated and then emptied so that when it is opened the wound is not flooded with fluid containing tumor-cells.
2. The patient is placed in moderate Trendelenburg position and a wide vertical suprapubic incision is made.
3. As the bladder is exposed extraperitoneally it is freed from its bed of fat and peritoneum by blunt dissection to either side of the urachus,

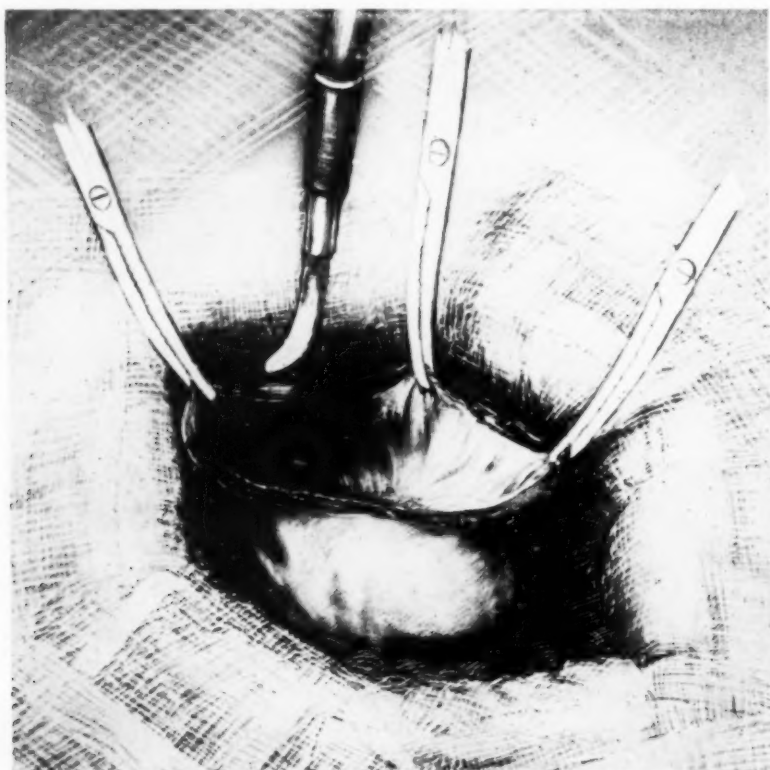


FIG. 6.—Wound in bladder is carefully seared, each clamp being removed as it is reached. Then all clamps off, and the patient being lowered, the wound (including the bladder) is completely filled with alcohol.

which is double clamped and cut between. The clamp in the bladder end of the urachus is used to draw the bladder forward and towards the symphysis as the peritoneum is sponged off its posterior surface. This may be opened accidentally and will allow of palpation of the extent of infiltration, etc., of the walls of the bladder.

4. After the bladder has been well freed down to the trigone in this manner, and delivered well out of the abdomen, the perivesical space is carefully packed off with several layers of gauze abdominal pads which protect the perivesical space and the incision in the parietes.



FIG. 7.—After removal of soiled gauze and of the alcohol, the charred incision in bladder is inverted with two layers of sutures leaving adequate opening for tube drainage.

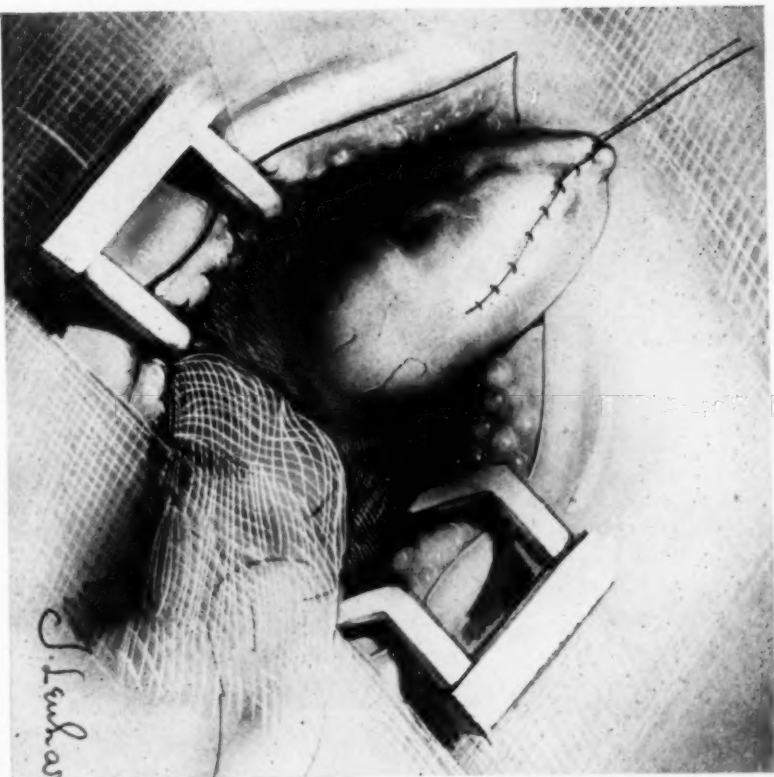


FIG. 8.—Outer layer of chromic catgut closing the incision in the posterior wall before replacing organ in its bed.

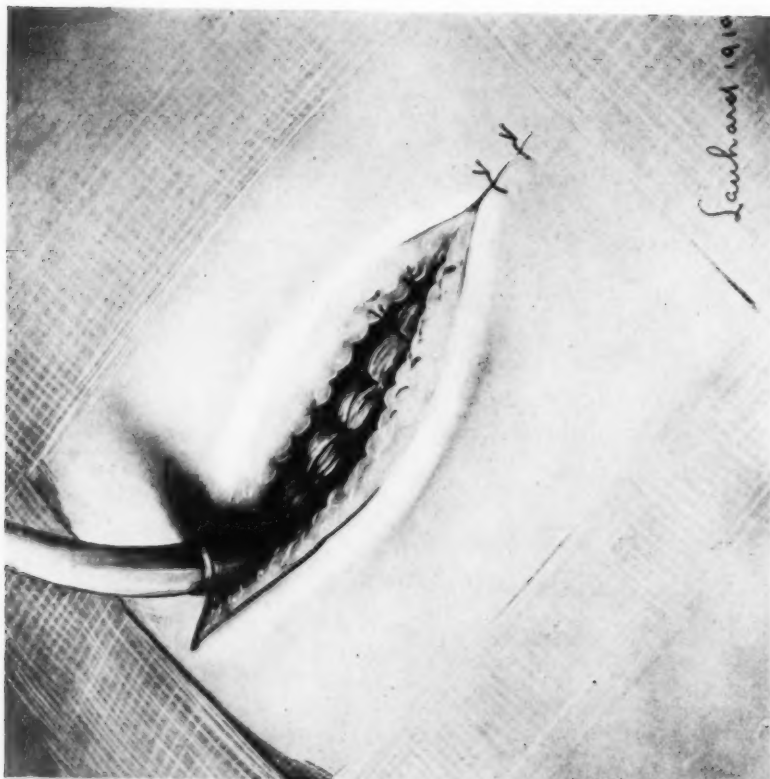


FIG. 9.—Layer suture of the parietal wound and tube at lower angle leading into bladder.

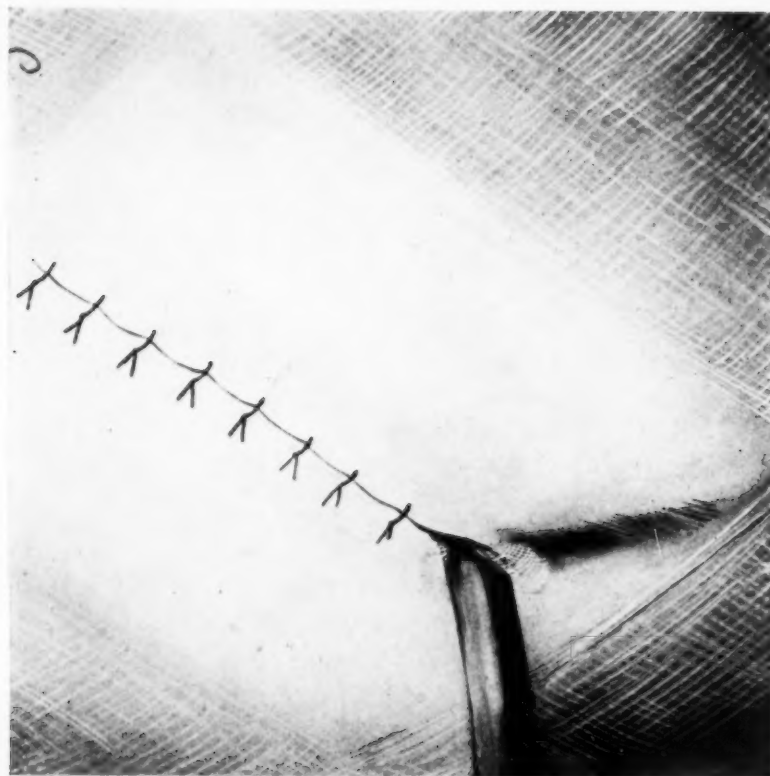


FIG. 10.—Drainage of superficial wound with gauze or rubber dam to suture line in bladder.



## OPERATIVE TREATMENT OF BLADDER NEOPLASMS

5. Then, depending upon the position of the growth or growths, the bladder is incised either through its anterior, its posterior or its lateral walls. The incision should be gradually enlarged so that wipes can sponge up the little fluid that may be in the viscus. Sponging within the bladder should be reduced to a minimum. As the incision is enlarged the papillary growth will become evident, and it is immediately cauterized *in situ* with the electric cautery (hook) or with the Paquelin (hooked point). In cases of multiple growths each growth is separately burnt, and every suspicious spot is treated similarly. A too-extensive cauterization is preferable to a too superficial. If the papillary growth is so large that it can not be treated in this ideal manner it may be seized with a blunt ring clamp and delivered piecemeal till the pedicle is reached, when a Carmalt-curved clamp is placed across this and the cautery slipped between the clamp and the bladder wall. If the bladder wall is infiltrated a wide cautery resection of this area is carried out. If a ureter is involved in the infiltrated area it is left attached till this area is resected and then cut away from the resected portion at a distance from the growth. Thereafter it is implanted in a healthy part of the bladder just before the bladder wounds are sutured.

6. Having a rather deep cavity to expose, it is wise to use retractors of different sizes and lengths rather than automatic retractors,<sup>1</sup> so that all surfaces of the organ can be gone over readily, and none are covered except momentarily by the blades of the retractors. Again, to hold the organ well out of the body, clamps without *teeth* are applied to the bladder incision as it is being made. The use of clamps with teeth such as the Kocher, which produce minute perforations in the bladder wall, thus possibly producing implants, should be avoided.

7. Being satisfied that all the visible tumor or tumors have been destroyed our next efforts are directed against possible cell implants. These may be in the bladder incision, loose in the bladder or on the gauze protective packings about the organ. The incision which opened the bladder is carefully seared with the cautery proceeding from clamp to clamp in orderly fashion, each clamp being removed in turn as the cauterization proceeds. Then the table is lowered, and the whole wound is filled for about five minutes with alcohol, the bladder being allowed to slip back into its bed so that its cavity as well as the protective gauze is exposed to the effects of the alcohol which it is hoped will coagulate any potential cell implants that have broken away during the various manipulations.

8. After this thorough bath in alcohol the gauze protective packings are removed, fresh gauze being substituted. The bladder is sponged dry, and its incision is closed after making provision for suprapubic tube drainage. (It is at this stage that the ureter is implanted in its new place.) In closing the bladder a layer of plain catgut sutures is used to

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<sup>1</sup> An automatic retractor in the parietal wound is essential and very helpful.



infold the charred edges of the incision, and over this a layer of chromic gut is applied to support the first layer.

9. The incision in the parietes is closed in layers, drainage with rubber dam or gauze to the bladder, both above and below the tube which enters that organ, completing the procedure.

From a consideration of the above points, I believe it will be agreed that everything that one can do to minimize the danger of implants has been employed, and it must be evident that such a thorough technic could only be carried out through an extraperitoneal approach. In infiltrating growths of the posterior wall involving or near the peritoneum one is perforce limited in one's activities, as the resection must include the peritoneum. This, however, is the only position in which the technic must be slightly modified and the alcohol flooding can not be used. In infiltrating growth involving the neck of the bladder total cystectomy is still "*sub judice*." In one case of this character in which I removed the bladder, prostate and vesicles, and who was shown to this Society some years ago, the patient lived over five years.

Whether radium should be used in the benign cases in which the high frequency method or the above operative technic is available, I believe should be answered in the negative. In operable malignant cases without or with moderate infiltration, I believe operation offers more than radium. In the advanced cases—and many cases of malignancy unfortunately fall into this group nowadays—radium has a very large field in which to demonstrate its efficacy.

## TIBIAL TUBERCLE AFFECTIONS

REPORT OF SEVEN CASES

BY RICHMOND STEPHENS, M.D.  
OF NEW YORK CITY

THIS condition is usually referred to as Osgood-Schlatter's Disease, but should really be classed as an injury and not a true disease. The subject has been so well presented by Osgood, Schlatter, Dunlop and others, that it is unnecessary to go into a detailed description here.

Six cases of this lesion were seen in the Out-Patient Department of the Hospital for Ruptured and Crippled, between October, 1916, and April, 1917, demonstrating its rather frequent occurrence. The war prevented us from following these cases, but recently, while attempting to collect them, a case was seen which is here added to the series. The six original cases were adolescent boys and the recent one is a woman of forty-one years but the facts make us believe that it belongs to this group.

The etiology is not definitely certain but is, in all probability, injury either from a direct blow to the tubercle of the tibia or from strong contraction of the quadriceps femoris muscle pulling through the patella and patellar ligament. It has generally been considered an affection occurring during adolescence and is usually seen in boys. This fact is in favor of it being traumatic in origin for young boys are usually active and frequently injured. The injury may be too slight to be recorded or may be from frequently repeated mild blows or strains. It is reasonable to suppose that in active youths the very strong tendon attached to the tubercle up to the time of ossification may cause its separation and lead to a non-suppurative inflammation. In later life the same signs may be due to a fracture or periosteal tear followed by periostitis.

In this small series of cases four of the boys and the woman gave a history of trauma and the other two did not. There was nothing in any of the cases to suggest local disease or infection, but we feel certain that there is always some inflammatory reaction as in cases of traumatic periostitis.

In the adult patient there was a history of injury and the examination showed a definite point of tenderness over the tubercle with slight heat, redness and swelling. The X-ray examination was negative, as was also the Wassermann reaction. Even though there had been previous similar trouble it responded to simple treatment consisting of rest and strapping with adhesive plaster.

The accompanying X-ray pictures of some of the boys show various types of tubercles. Some could easily be considered as separate ossification centres, some as lips projecting down from the epiphysis and others

look as though they had been torn or pulled from the tibia. However, it will be noted that similar conditions are seen on the normal side and in some cases one might suspect that there was even more trouble on this side.

The treatment in all of the cases was rest and strapping and in practically all this was sufficient. One resistant case was put up in a plaster-of-paris bandage. I regret that the cases have not been followed longer but efforts to locate four of the boys have failed. The adult is still under observation but is markedly improved. Several cases have been reported that were treated by operation where the conservative treatment apparently was not sufficient or where the case had been considered more serious in character. Personally, I have not seen such cases and I have not found any reports which state that the prognosis of the final outcome is at all bad. Of course, it is conceivable that the duration of the disability might be shortened by operation, but it would seem to be practically unnecessary to subject a patient to such treatment.

CASE I.—I. A., schoolboy aged fourteen years. First seen October 21, 1916.

*History.*—About two years ago he twisted his left knee inward while playing basket ball. Had considerable pain and had to stop playing. Pain persisted for two weeks but he was able to get about with a limp. After this he only had pain on rainy and cold days. Six months later he had more pain and was told at a hospital that he had a strain but received no treatment.

*Examination.*—Came in with a limp, slight pain and a tender swelling just below the left knee. Examination revealed an enlargement about one inch in diameter over the left tibial tubercle which was tender but showed no redness or ecchymosis. There was no fluid in the joint and no limitation of motion. Examination of the right knee and leg was entirely negative.

*X-ray* shows a condition which might be interpreted to be a periosteal tear or a separation of a centre of ossification. (Fig. 1.)

*Treatment.*—Adhesive plaster strapping for two months and then a canvas knee-lacing which covered the joint and extended down about three inches below the tubercle.

*Examination* (March 1, 1917)—After four months' treatment the patient feels perfectly well and the knee appears normal.

March 1, 1920.—Efforts to locate the patient have failed.

CASE II.—J. D., schoolboy aged fifteen years. First seen October 31, 1916.

*History.*—Five years ago he was knocked down by a heavy truck and one of the wheels ran over his left knee. Wore a plaster-of-paris bandage for three months with the leg in extension. He was then well until eighteen months ago when he began to have some pain below and in front of the knee. The leg was said to be "weak" and there was a hard tender mass present. He was then treated with adhesive plaster strapping for about nine months without relief.

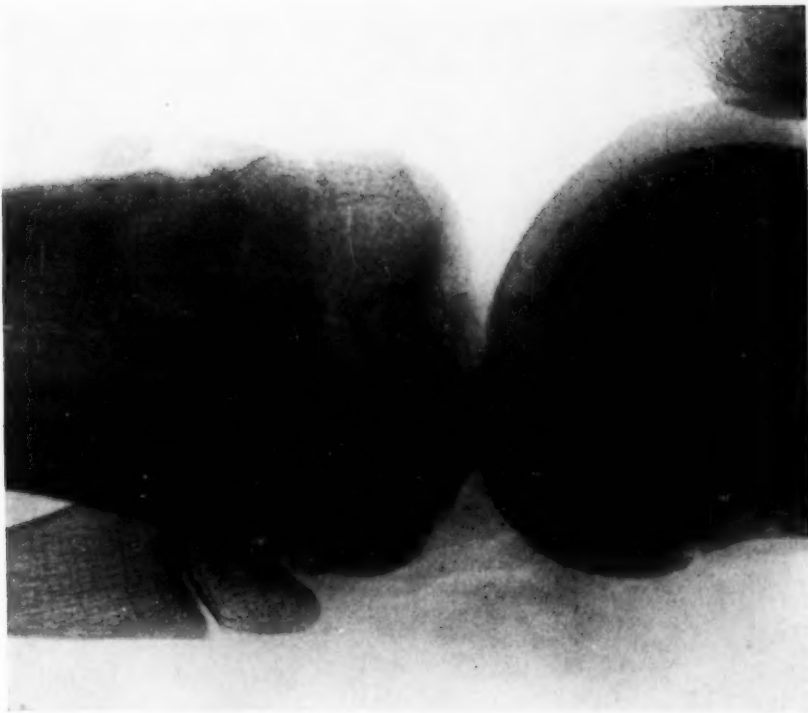


FIG. 1.—Case I. Left knee. Tubercle appears as separate bone fragment just below the tongue-like projection from the epiphysis.

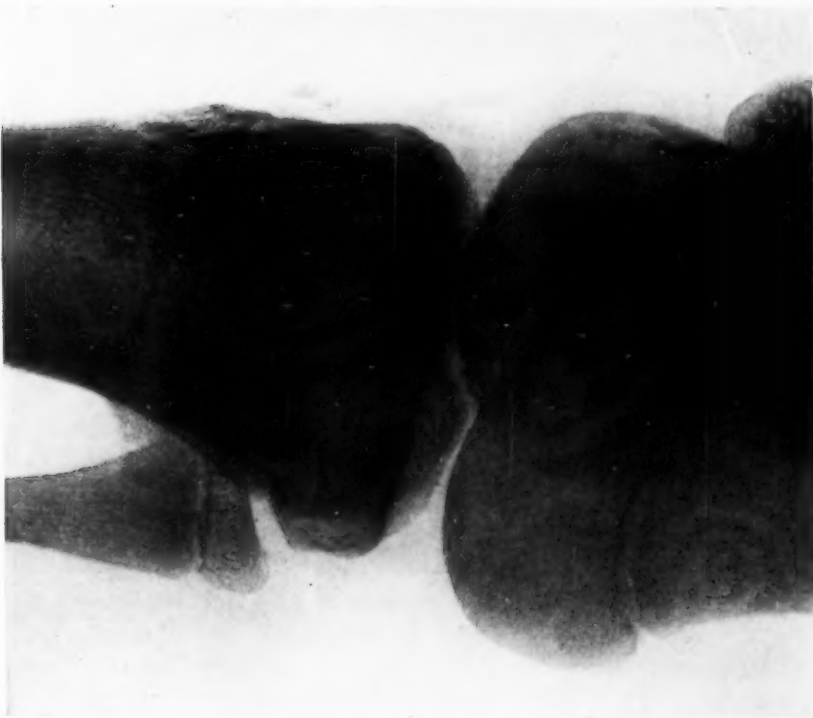


FIG. 2.—Case II. Left knee. Appears to be a long area in the patellar ligament near its insertion.



FIG. 3.—Case III. Left knee. Shows the tongue-like process from epiphysis, which is about the most frequent type seen.



FIG. 4.—Case IV. Right knee. Appears quite similar to the left.



## TIBIAL TUBERCLE AFFECTIONS

*Examination* revealed a tender swelling over the left tibial tubercle about one inch in diameter with no redness, heat, ecchymosis, limitation of motion or signs of fluid in the knee-joint. The right knee was negative. He claimed that the pain was worse during active exercise and especially on going up or down stairs.

*X-ray* appeared as a case of periosteal tear while that of the other knee was more like a simple projection at this point. (Fig. 2.)

*Treatment.*—Adhesive plaster strapping for about two months and then a canvas knee-lacing. He did not improve and would not



FIG. 5.—Case V. Right or affected knee. Showing area of ossification at point of insertion of patellar tendon, which is rather hazy in appearance.

try to rest the part, so we applied a plaster-of-paris bandage with the leg extended, for a month. We then returned to adhesive strapping and the lacing and he was improving but could only be followed for three weeks.

*March 1, 1920.*—Efforts to locate the patient have failed.

*CASE III.*—G. McC., schoolboy aged thirteen and a half years. First seen February 6, 1917.

*History.*—Definite injury denied but he says he often fell on his knees. One month ago he began to have some pain and noticed a swelling on the front of the left leg just below the knee. Severity has slowly but gradually increased. Two weeks ago he says he

could not fully straighten the leg because of pain and "stiffness," but it is now improved.

*Examination* shows a swelling one and one-quarter inches in diameter over the left tibial tubercle which is tender but not red, hot or ecchymotic. There is no fluid in the joint and no limitation of motion. On motion there was a soft grating sensation over the patellar ligament. He claims that the pain is increased by active exercise and especially on going up and down stairs. The right knee showed a similar swelling, but it was not tender or bothersome.



FIG. 6.—Case V. Left or unaffected knee. Showing very large and prominent tongue-like process from the epiphysis.

*X-ray* showed a lip-like projection down from the epiphysis and this was identical on both knees. (Fig. 3.)

*Treatment*.—Adhesive plaster strapping.

*Examination* (March 1, 1917).—Condition improving but patient could not be followed after this time.

*Examination* (April 10, 1920).—Patient says he has had no trouble since March, 1917, and now can only tell that the left leg was involved by the fact that the tubercle is slightly larger on that side.

CASE IV.—P. S., schoolboy aged fourteen years. First seen January 30, 1917.

*History*.—Denied injury. Four months ago began to have some

## TIBIAL TUBERCLE AFFECTIONS

pain just below and in front of the left knee. A few days later the same trouble started on the right side. Has been unable to kneel and has most pain when exercising or climbing stairs.

*Examination.*—A tender enlargement of bony hardness over the right tibial tubercle. No crepitus, redness, heat, limitation of motion or signs of fluid in the knee-joint. The left knee showed an identical condition except that there was less enlargement.

*X-ray* revealed a tongue-like process from the epiphysis on the left tibia which appears as though it had been fractured through the



Fig. 7.—Case VI. Shows apparently separate bone fragment or ossification centre at point of insertion of patellar ligament.

epiphysis into the joint. The condition appears almost the same on the right side. X-ray pictures about four months later show the conditions just the same.

*Treatment.*—Adhesive plaster strapping of both knees. There was no improvement during the first month, but four months later when the second set of pictures was taken the patient was practically well.

*Examination* (March 1, 1920).—Efforts to locate the patient have failed.

CASE V.—J. M., schoolboy aged fourteen years. First seen April 17, 1917.

*History.*—Injury denied. For the past three months he has had pain just below the right knee on the front of the leg when he kneels. There has been some slight swelling visible during this time. The condition has been stationary and he has not had any treatment.

*Examination.*—A tender swelling on the right tibia over the tubercle. No redness, heat, crepitus, limitation of motion or fluid in the joint.

*X-ray.*—A hazy appearance suggestive of a periosteal tear. (Fig. 5.) The left or normal knee showed a long pronounced tongue-like process from the epiphysis. (Fig. 6.)

This case did not return for treatment and all efforts to locate the patient since have failed.

CASE VI.—B. W., schoolboy aged eleven and a half years.

*History.*—Patient had pain in the region of the right tibial tubercle for one week. No history of injury. There was a swelling in this region which was hot and tender. The left side showed a similar swelling but it did not cause him any trouble.

*X-ray.*—Right knee showed the tubercle as a separate body apparently not attached to the tibia proper (Fig. 7).

NOTE (March 1, 1920).—A letter from the patient states that he was under treatment with adhesive plaster strapping for about nine months and that he has been well ever since, with the exception that at times in bad weather it "grows stiff and pains."

CASE VII.—V. D., housewife aged forty-one years. First seen November 1, 1919.

*History.*—Three years ago the patient fell and hurt her right leg just below the knee. The pain lasted about four weeks and she did not have any treatment. Four weeks ago the pain returned in the same place and she does not recall having injured the leg again.

*Examination* shows heat, redness and some swelling over the right tibial tubercle which is very tender. She says there is almost constant pain of a rather dull character. Wassermann, negative. X-ray, both knees negative.

*Treatment.*—Adhesive plaster strapping.

*Examination* (Feb. 28, 1920).—Patient is still under treatment, but is much improved. There is no swelling, heat or redness now, but the region over the tubercle is still tender.

#### CONCLUSIONS

1. Affections of the tibial tubercle are seen frequently during the period of adolescence, especially in males, but occasionally in adults.
2. They are inflammatory, non-suppurative, and due to injury.
3. The disability is rarely complete and the prognosis is good.
4. The treatment should be rest, protection and sometimes immobilization. Operation is only indicated in exceptionally protracted cases.

## TIBIAL TUBERCLE AFFECTIONS

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## HYSTERECTOMY IN THE LANKENAU (FORMERLY THE GERMAN) HOSPITAL\*

REPORT OF ONE YEAR'S (1919) WORK INCLUDING THE WRITER'S EXPERIENCE WITH RADIUM IN UTERINE CONDITIONS DURING THE YEAR, AND REMARKS UPON THE PATHOLOGY: BY STANLEY P. REIMANN, DIRECTOR OF THE PATHOLOGICAL LABORATORIES, LANKENAU HOSPITAL

BY JOHN B. DEEVER, M.D.  
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THE year's (1919) work in hysterectomy at the Lankenau Hospital of Philadelphia comprises 130 operations, of which 46 were complete and 84 subtotal. Two deaths in the entire series yields a mortality of 1.5 per cent.

A complete hysterectomy was done for simple uncomplicated fibroids in 7 instances and in 14 for fibroids with one or more complications. In addition to these there were 10 cases of prolapsus uteri, with acute or chronic inflammation of the cervix, tubes and ovaries, necessitating a complete hysterectomy. The series also included 5 cases of carcinoma of the uterus, one of which presented extensive ulceration, gangrene and purulent infiltration at the site of radium treatment, by no means an isolated instance of this kind that has come to my notice. The one death among the complete hysterectomies was due to myocarditis.

Subtotal hysterectomy for fibroid was done in 84 cases, 12 being simple non-complicated and 72 complicated—the complications being salpingitis, tuboövarian inflammation, pyosalpinx, anomalously located fibroids, pregnancy, nephritis, endocarditis, etc.

In this series of 84 cases there was not a fatality. Malignancy was present in 2 instances, in 1 associated with carcinoma of the breast. Sarcoma was noted in 1 case. In 7 instances degeneration of the myoma had occurred, hyaline 6 times and calcareous once. Adenomatous polypi of the uterus, cervix or both were present 5 times.

The fatal case in this series was due to enterovaginal fistula, the result of radium treatment.

Total hysterectomy for fibroid or fibroids should be the better operation, particularly when the patient is near, at, or past the menstrual epoch, and especially when there is any doubt about the condition of the cervix or the endometrium. Were this the usual practice there would be less likelihood of subsequent carcinoma and a recurrence of the fibroid of the cervix, which I have seen, necessitating a difficult operation for its removal.

The operation I make in subtotal removal is amputation of the supravaginal cervix by a V-shaped incision, which leaves a wedge-shaped cavity in the cervix, into which cavity I implant the stump of the broad ligaments, the operation being completed by bringing over the stump and

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\* Read before the American Surgical Association, St. Louis, Mo., May 3, 1920.



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stitching to the posterior surface of the cervix the reflected flap of the peritoneum carrying the bladder with it, the latter being the first stage of the operation.

In total removal of the uterus I free the upper portion of the vagina with the uterus, apply a right-angle clamp to the vagina and amputate with the actual cautery, closing the vagina by continuous suture carried around the clamp; clamp removed and ligature secured. The stumps of the broad ligament are fixed to the vaginal stump and all covered by pulling the reflected peritoneal flap backward and over the stump and stitching to the posterior wall of the vagina. This makes an extraperitoneal operation practically, and thus avoids a possible chance of infection from the vagina. I practice this operation with satisfactory results in a percentage of cases of complete prolapse of the uterus and the vagina or of the vagina alone.

In large soft myomas, which at times make the uterus look so much like a pregnant one, I have no hesitancy in incising through the anterior wall of the uterus, thus making sure.

My confidence in the operation of transperitoneal hysterotomy is so great that I have equal confidence in opening the uterus to the light of day under the above-mentioned conditions. The other and many complications arising in connection with this form of surgery are so familiar to you all that I will not discuss them, nor is it necessary for me to say that submucous fibroid of the uterus, that cannot be safely removed through the cervix, is best and most satisfactorily handled by making a transperitoneal hysterotomy.

When the fibroid uterus is very large or the fibroid grows chiefly from the supravaginal cervix or out into the broad ligaments, I frequently am able to shorten the operation as well as have less blood lost by amputating the supravaginal cervix from side to side, from behind forward or splitting the uterus vertically, etc. The uterus amputated, the cervix grasped and held steadily with a vulsella forceps is readily removed.

The greatest danger of complete hysterectomy is, of course, the risk of injury to the ureters. But this can be avoided by exposing the ureters well back in the broad ligament and tracing them forward to the bladder, so that they are constantly in view when tying off the vessels. But should accidental lateral ligation of the ureters occur, as it may even to the most expert operator, it manifests itself promptly and can be corrected.

Myomectomy for the subserous pedunculated fibroid is a very satisfactory procedure, but the submucous type, provided it does not present or project into the cervix, is to my mind better attacked by transperitoneal abdominal hysterotomy. For large-sized intramural fibroids also, I believe, a subtotal or complete hysterectomy to be much less momentous, from the standpoint of immediate and of secondary bleeding, than myomectomy. So many of this class of patients are highly anæmic that there is danger in any operation that is attended by even

a minimum loss of blood. Furthermore, it is my experience that most of the women with fibroid uterus are sterile; so the argument that some few become pregnant after myomectomy does not affect my view, although I admit it to be a debatable one. I have known a few instances of recurrence of fibroid in a myomectomized uterus; therefore, this possibility must be reckoned with.

A full discussion of any one point mentioned would take more time than the rules of the association permit. I have therefore contented myself with merely touching upon them. If I succeed in instilling the necessity of caution as to the use of radium into the minds of those present I shall be satisfied.

*Radium in Uterine Surgery.*—During the same year (1919) 58 cases were treated with radium, 39 for carcinoma of the cervix, 12 for carcinoma of the uterus, 5 for myoma uteri, and 2 for chronic endometritis. One death makes the mortality figures about the same as in the operated series. While, of course, figures standing alone are not convincing, I believe they speak favorably for surgery in this instance. I emphasize this the more especially as I am so often confronted with the destructive action of radium, such as gangrene, ulceration and purulent infiltration at the site of the application, that I must necessarily hesitate to sound its unqualified praises.

With the introduction of any new therapeutic agent there very naturally arises the hope that the solution of a perplexing problem is at hand. Radiation in the treatment of disease of the cervix and uterus has proved no exception to this rule. More or less enthusiastically, usually more, during the past several years the röntgenologist and radium therapists have been so loud in their praise of their results that the protesting or opposing voices have been in danger of being drowned. It is not, however, as a total opponent to radiation in the treatment of these diseases that I ask to be heard at this time, but rather for the purpose of introducing a different note, perhaps in a lower key, into the melody.

First and foremost I believe that in the decision for or against the use of radium the voice of the surgeon should be accorded equal if not greater weight than that of the radiologist. Every fair-minded surgeon is free and indeed glad to acknowledge that radium can control uterine bleeding, in fact arrest it; and that together with the X-ray the size of intramural and submucous fibroids can be reduced if not entirely dissipated. But there remains to be considered the effect of the presence of mutilated and destroyed tissues. Is not a woman better off without a uterus or with only the neck of one than she who harbors an organ that has been burned to death? Is not this a rather undesirable tenant of the human body? Better an empty house than an undesirable tenant. Moreover, radium treatment for fibroids has in four instances that have been recently brought to my attention been the direct cause of death, the

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fatal outcome being due to peritonitis in one case, rectovaginal fistula in another and extensive pelvic suppuration in the remaining two.

It is my practice to make a transperitoneal complete removal of the uterus in all cases of carcinoma of the fundus and in very early carcinoma of the cervix. I am sure this is the better practice than is the use of radium in this early stage. Recalling the free lymphatic supply of the cervix and that the lymphatics pass through the broad ligaments, is not this a better surgical procedure than to apply radium? Radium should, in my judgment, be used only in the late cases, those in which lymphatic involvement has gone beyond the reach of the knife. In the latter class of cases, radium properly used without doubt prolongs life, but that it cures, I doubt. I have never seen a case of advanced cancer of the cervix, where the entire cervix has been involved, cured by radium. I have, under the latter circumstances, seen the cervix under the administration of radium practically returned to apparently normal conditions, but, sad to say, followed by recurrence in a comparatively short time, which recurrence in my experience is seldom benefited by the further use of radium.

Even in the non-malignant uterus with free hemorrhage, where in the absence of adnexal complications radium has a recognized field, the cases should be judiciously selected. Menorrhagia in a young woman is a serious matter and requires careful study. Very often hysterotomy is the better method for arriving at a correct diagnosis and determining existing pathology, and is indicated rather than curetting through the vagina or the application of radium. Too often, I fear, the specialist may yield to the persuasion of his clients and administer radium to relieve the inconvenience of menstruation prolonged a day or two beyond the usual time, unmindful or perhaps ignorant of the fact that the indiscreet use of radium in a young woman suffering from menorrhagia or metrorrhagia is liable to lead to sterility. It is against such illegitimate use of the substance that I would register a most serious protest.

While in some cases of chronic endometrial inflammation radium has proved useful, I believe here also it should be used only after all other recognized means of treatment have failed.

Very often the differentiation of quiescent appendicular inflammation and latent non-palpable tubal disease can be made only by opening the abdomen and inspection; therefore, in the presence of this uncertainty as to the propriety of using radium the knife is the better arbiter in the matter.

In a number of cases of purulent leucorrhœa, radium has failed to be of value, and while curetting, cauterization of the endometrium or the application of iodine, etc., may be efficacious, there is little chance of these measures proving so on account of the probable involvement of the tissues adjacent to the endometrium, so that removal of the uterus either by the transperitoneal or the vaginal route offers the only hope of cure.

Since the demonstration of normal cyclic changes in the endometrium, much confusion regarding hypertrophy and hyperplasia of the endo-

metrium has been cleared up. The pathological diagnosis of hypertrophic and hyperplastic endometritis is made very much less frequently than before. That there is, however, a type of change in the endometrium consisting of both hypertrophy and hyperplasia is unquestioned, but its frequency is comparatively low. Irrespective of changes incident to the menstrual cycle, a few uteri will show a shaggy, thickened endometrium, sometimes pale, often with small areas of congestion or even hemorrhage. This fringy condition is very often not universal but focal, and is especially seen over myomata projecting into the uterine cavity. Histologically the glands are larger, increased in apparent number, and often-times appear in marked corkscrew form. Excess secretion and rarely red blood-cells are seen in the lumina of these glands with congestion of the interstitial tissue.

Cellular infiltrations, if due regard be paid to the menstrual cycle, are relatively uncommon. They may consist of plasma-cells and inflammatory lymphocytes. At the menstrual period cellular infiltrations in which the polymorphonuclear leucocyte appears in goodly number, are, of course, the rule. Cystic changes are also occasionally seen in the hypertrophic endometrium; the cysts are microscopic and may be empty or contain varying amounts of *débris*.

Chronic endometritis in the sense of fibrosis and round-cell infiltration is one of the rarest of changes observed in our specimens. In several instances it was definitely associated with long-standing inflammatory processes in the adnexa. With the average run of specimens the number of times an endometritis can be diagnosed is very small. Those in which acute endometritis varying from mild to severe, almost phlegmonous type occurs are constantly associated with acute inflammations of the adnexa.

The subject of myopathic hemorrhage has received considerable attention and quite extensive pathological and histological investigation. The consensus of opinion at the present time states that the hemorrhages are due to functional disturbances of the ovary and associated ductless glands. Certain it is that definite, constant pathologic anatomic changes, either in the endometrium or ovary, are conspicuous by their absence in certain cases of uterine hemorrhage even when constitutional causes, such as incompetent myocardium, anæmia, etc., can be ruled out. This explanation in a way avoids the issue; it takes the place of explanations such as apoplexia uteri, endometritis senilis, mucoid degeneration of muscularis, etc., which were in vogue until investigated and found wanting.

The ovarian functional explanation is one which presents far more difficulties of proof or disproof than the others. Anspach, from careful histological studies, concludes that certain of these hemorrhages might be explained by a failure of the usual sclerotic change following childbirth. Reasoning by analogy the elastica present in the uterine wall may

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be expected by the very nature of the normal changes through which this organ passes during menstruation and the child-bearing act to play a very considerable part in the physiology of the vessels. Failure of this tissue to functionate may easily lead to otherwise inexplicable bleeding.

Of the action of radium on tissues two striking changes have come to notice and on which all authors agree. They are an increase of connective tissue and a decrease of parenchyma. The most complete studies have, of course, been made of its effects on carcinoma. The connective-tissue overgrowth presents the most striking picture, but recent investigations by Alter, for example, show that the destruction of parenchymatous cells is the most important. The chromatin substance of the nuclei displays a great sensitivity toward the rays of radium and undergoes a deep-seated chemical change. The final result is a destruction of the nucleus and a scattering of the chromatin. The connective-tissue increase seems secondary, its purpose to replace the destroyed parenchyma. There is, apparently, no stimulation of this tissue to active growth by radium.

Two specimens have been especially studied in this laboratory at periods varying from one week to five weeks after radiation. The organs were removed surgically. The first specimen was that of a squamous-cell carcinoma of the cervix. Great destruction of carcinoma cells was evident, with intense congestion and polymorphonuclear and other cell infiltration. The destructive effect was manifest through the length of the cervical canal and extending into the wall approximately one-half inch. Beyond this living carcinoma cells were plentiful. The other patient presented a continuous small amount of hemorrhage and was suspected of having carcinoma of the fundus. The uterus was very soft and boggy and the entire uterine cavity showed an intense inflammatory reaction, with mucosa and considerable muscle immediately about the site of the radium necrotic and deeply ulcerated. The remainder of the uterine mucosa also showed ulceration extending from a part to a whole of this structure. Beyond the necrotic part, and extending throughout the entire wall of the uterus, was an extraordinarily violent inflammatory reaction. Sections from other parts of the uterus showed the same oedema, pus-cell infiltration, hemorrhage and congestion, but to a less degree. Tubes and ovaries also gave evidence of acute inflammatory reaction, but to a still less degree. A small amount of fibrin was present on the peritoneal surfaces. Reparative processes were practically entirely absent. No carcinoma was found.

There can be no doubt, therefore, of the intense destructive activity of radium. If the dose can be so graduated to destroy endometrium when this is desirable, its field of usefulness is, of course, established. When, however, its destructive properties are not controlled or controllable, its potentialities for harm are limitless.

Since the endometrium in the cycle of its normal functions under-



goes marked anatomic changes, it follows that for intelligent interpretation of anatomic pictures it is essential to consider the data of menstruation with the specimen of pathologic report. The age of the patient and the number of pregnancies and childbirths is also important, for these factors influence the musculature, blood-vessels and interstitial tissues. Especially is this important in the final judgment in cases of so-called myopathic hemorrhage, when all constitutional factors have been ruled out and there remains a uterus with no lesions discoverable by ordinary means.

Much of the confusion attending these diagnoses and many of the coincident questions, for example, can a hypertrophic endometrium bleed? will then be cleared up. Then the effects of therapeusis, whether by radium or surgery, can be better estimated.



## NOTES ON THE NON-OPERATIVE TREATMENT OF FRACTURES \*

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*Introduction.*—We have been much impressed lately with the enormous literature that obtains on the operative treatment of fractures. Almost every medical journal contains some related article on this subject and, although undoubtedly the non-operative treatment is still the method of choice in fracture cases generally, it is hoped that such reports as this may tend to confirm the followers of this method in the propriety and advantages of their work. Certainly they follow the more accepted path. And yet we do not lose sight of the fact that from the time of Owen Thomas on, the open reduction of certain fractures has been advised. We feel, however, that at the present time the brilliant work of Arbuthnot Lane has swung the pendulum too far and that unnecessary risks are now being taken in operating upon fractures easily and possibly better treated by the closed method.

If there is any one branch of medicine in which the recent experience gained by observation of battle casualties has been of distinct value it is that concerned with the care and treatment of fractures. And that experience, which by force of circumstance was enormous, brought out certain principles of treatment that are applicable to civil fractures whether compound or not. The chief lessons learned were: (1) The success of mobilization in the treatment of infected joints, and (2) the value of traction in the care of fractures generally. With the first of these lessons it is not our concern in this present paper.

The principle of traction in fractures is by no means new. Indeed, it antedates the more modern conception of the operative treatment so urgently supported by Mr. Arbuthnot Lane. Yet in recent years, traction had fallen somewhat into disuse through the brilliancy of a few operative reductions in which mechanical splinting was used and the general impression that immediate reduction and fixation in plaster gave better results. Certainly in the medical schools of the present day, or rather in the years immediately preceding the war, students were not much impressed by their instructors with the value and efficacy of slow, continuous traction. To those to whom the war gave the opportunity to study fractures in vast numbers, the results obtained by traction at first seemed almost marvellous, especially when the simplicity of the method was appreciated. It was soon found that traction in the direction of an extremity would in almost every incidence, if of sufficient amount, bring displaced bones into alignment. Accessory padding or lateral pulls were unnecessary, since fascial planes and neighboring muscle bellies, when

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\* From the Surgical Clinic of the Peter Bent Brigham Hospital, Boston, Mass.

made taut, soon brought the displaced fragments into alignment, no matter what the deformity. It is doubtless true that in the battle casualties considerable bone was often lost, so that this might be considered as making the realignment of fragments more easy to obtain.

A further observation, by no means new, but now perhaps best emphasized, was the malleability of callus at late periods. Thus, a badly deformed fracture of the femur as late as three weeks or even longer, and with visible callus formation and shortening, if submitted to sufficient traction could be pulled down to full length and good alignment obtained. Evidence of the elasticity and malleability of callus formation is presented by Sinclair,<sup>13</sup> Blake,<sup>2</sup> and Bowlby,<sup>3</sup> who have written that fractures of the femur twelve weeks after injury, when made ambulatory with splints, shortened considerably. Sinclair, therefore, purposely gave his cases with fractures of the femur from  $\frac{1}{2}$  to  $\frac{3}{4}$  inch lengthening before making them ambulatory.

Since this evidence is not yet thoroughly appreciated, it seemed that examples of its application to civil surgery might be of some value in making the use and value of traction more widespread and of diminishing the number of open operative reductions in which the added risk of anaesthesia, sepsis, and mechanical failure are always present. It would seem only wise to try the simplest procedure first, especially when its efficacy is proved. The first case is presented as an example of the efficacy of traction even when applied late in the healing of a fracture and is cited in preference to other cases because of the divided opinion as to whether operative or non-operative treatment should be used in this very instance. The second case is presented as an entirely different type of fracture in which operative methods of reduction are not uncommonly applied, but in which both this case and the evidence presented in the literature demonstrate the success of non-operative methods.

*CASE I.—Fracture of right femur, S. S., Peter Bent Brigham Hospital, No. 24214 (Surg. No. 12100), male, aged thirty-five years, married, two children; occupation, painter and contractor.*

*History.*—Born in Russia, has always enjoyed good health. No history of serious illness, accidents, previous operation, nor chronic disorders. Present weight is 135 pounds. Admitted to Peter Bent Brigham Hospital March 19, 1920, complaining of a sore right knee. Four weeks before admission (February 20th), while walking along a corridor, stubbed his left great toe on a loose piece of moulding and fell forward, striking on his right knee. The knee was painful and locomotion impossible. He was carried to a nearby hospital where an X-ray plate was taken and he was told there was no fracture. He was carried home and remained in bed ten days, the right knee being very sore and motion practically impossible. But as he thought the bone was not broken, he attempted crutches on the tenth day (March 4th), and although suffering considerably was able to go to his shop. While there, forgetting his injury, he sud-



FIG. 1.—Case I. Fracture of shaft of femur; condition at end of four weeks, lateral view.



FIG. 2.—Case I. Antero-posterior view.

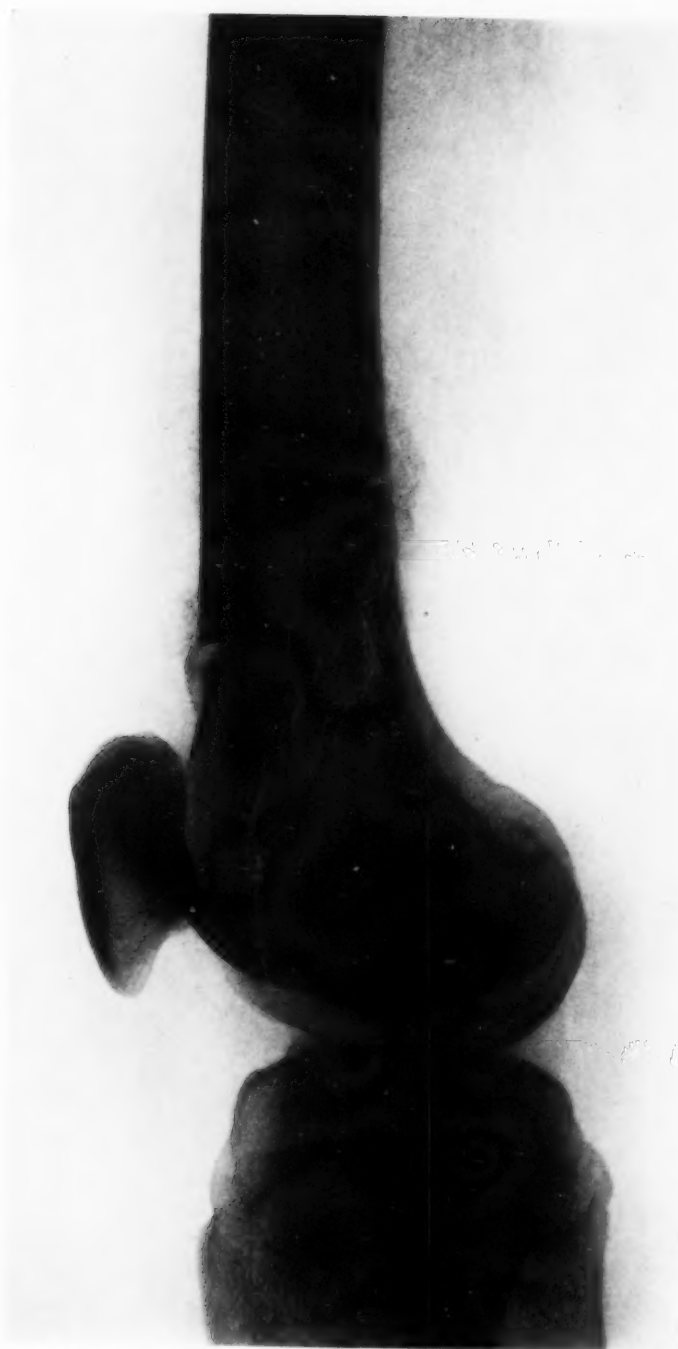


FIG. 3.—Case I. Six days after application of adequate traction; lateral view.



FIG. 4.—Case I. Six days after application of adequate traction; antero-posterior view.



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denly tried to stand up without his crutches, had very severe pain in his knee and collapsed on the floor, although he broke the fall as best he could. He was then taken to another hospital where his leg was carefully examined and, although he asked for X-ray studies, none were taken, as they told him there was no fracture and such studies were unnecessary. After remaining in bed ten days he became dissatisfied and went home (March 13th). Six days later, after suffering considerable pain, he came to this hospital (March 19th).

*Examination.*—A well-developed, healthy appearing young man lying in bed with his right knee slightly flexed and resting on a pillow. The general physical examination revealed no pathology beyond the local lesion in the right knee. The left leg was perfectly normal and the knee jerk and ankle jerk within normal limits. The right leg was held slightly flexed at the knee. There was a distinct swelling about the knee, beginning just at the tibial tubercle, and extending well up beyond the epicondylar region. There was some redness of the skin and fine excoriations apparently due to the application of iodine. Palpation revealed increased density of the swelling which was fusiform in shape, and apparently above the joint proper in which no excess fluid could be demonstrated. Moreover, the swelling was mostly anteriorly and it seemed as if there was an anterior bowing of the femur in the epicondylar region. No abnormality in the popliteal vessels could be demonstrated, and no nerves seemed to be interfered with. Abnormal mobility and crepitus could not be elicited, but motion of the joint was painful and limited.

With the history of trauma four weeks preceding, the angulation, and the swelling which we took to be callus, a diagnosis of fracture was made and radiographs (Figs. 1 and 2) revealed a T fracture, the transverse line being in the epicondylar region and the vertical line lying between the condyles and entering the joint. There was little separation of the condyles and, though more marked anterior bowing, the fragments seemed to some extent impacted, and the newly formed bone of the callus was barely demonstrable.

*Treatment.*—The case was presented at rounds where a lively discussion ensued as to treatment. The majority of observers, comprising the staff and visiting surgeons, believed that open reduction was necessary, and there was much debate as to the length of time after injury that callus remained malleable. Doctor Harvey Cushing cited Sinclair's experience that even as late as twelve weeks in femur cases shortening occurred with weight bearing, presumably due to elasticity in the callus. Our own experience led us to hope that in this case even such a large and definite callus might be moulded by traction. The advisability of using a Steinmann pin or Ransohoff tong for traction was brought up, to which the objections were raised that in the first case the insertion of the pin might separate the condylar fragments, and in the case of the tong, the application at exactly the right points on the lateral surfaces of the

condyles, in order to get posterior pull on the lower fragments, was extremely difficult. Moreover, both were to some extent operative procedures, and, though indeed slight, carried the added danger of sepsis. In any actual operative interference the danger also lay of freeing the impaction and thus suddenly allowing the gastrocnemius to exert its pull, thus converting an unusual deformity in lower femur fractures into the common but even more difficult type for treatment where the lower fragment is pulled posteriorly. We suggested that while the case still remained under debate, simple glue extension be used. The danger in this form of traction presented itself solely because of the possibility that the vertical line of fracture may have run into the insertion of the crucial ligaments and that traction below the knee might, therefore, separate joint surfaces and pull off what attachments of these ligaments remained intact at their femoral source.

This plan was temporarily accepted (March 20th) and glue extension was applied to the lower leg from ankle to knee, the leg supported in a Hodgen splint suspended from a Balkan frame, about fifteen pounds of weight attached for traction, the foot of the bed elevated and slings so arranged below the leg and thigh that the line of pull was in slight flexion. For about twenty hours the patient complained of pain in the knee, but thereafter was very comfortable, more so than he had been since the injury. The anterior bowing in two days was markedly diminished, and when control plates (Figs. 3 and 4) were taken six days after the application of traction (March 26th), the reduction to perfect alignment had been accomplished. The next day the Hodgen splint was removed and the leg placed on a pillow with two pounds of extension only to assist at immobilization. Callus now was clearly visible and the danger of a posterior displacement we thought passed. The swelling about the site of the fracture greatly diminished, the skin became wrinkled, and all pain disappeared. Motion in moderation elicited very little pain.

A week later traction was discontinued, as six weeks had already intervened since the injury, and we felt the fragments would not change. However, X-ray studies on April 9th showed that the anterior bowing had partly recurred (Fig. 5) and traction was again applied for a week, when the fragments were again found to be in good alignment (Fig. 6) (April 16th). After another week the patient was gotten up and given crutches, but bearing considerable weight on his fractured leg. Motion at the joint satisfactory, full extension, and over 90 degrees flexion. He was told to begin to discard his crutches.

*Discussion.*—The atypical deformity in this case is explained by the mechanism of the force applied during the injury and by the fact that the fracture was probably impacted and never loose. Had it been a loose fracture, the lower fragment would certainly have been pulled into the popliteal space. The vertical fracture which ran into the joint added



FIG. 5.—Case I. Recurrence of bowing upon discontinuance of traction six weeks after fracture was sustained.

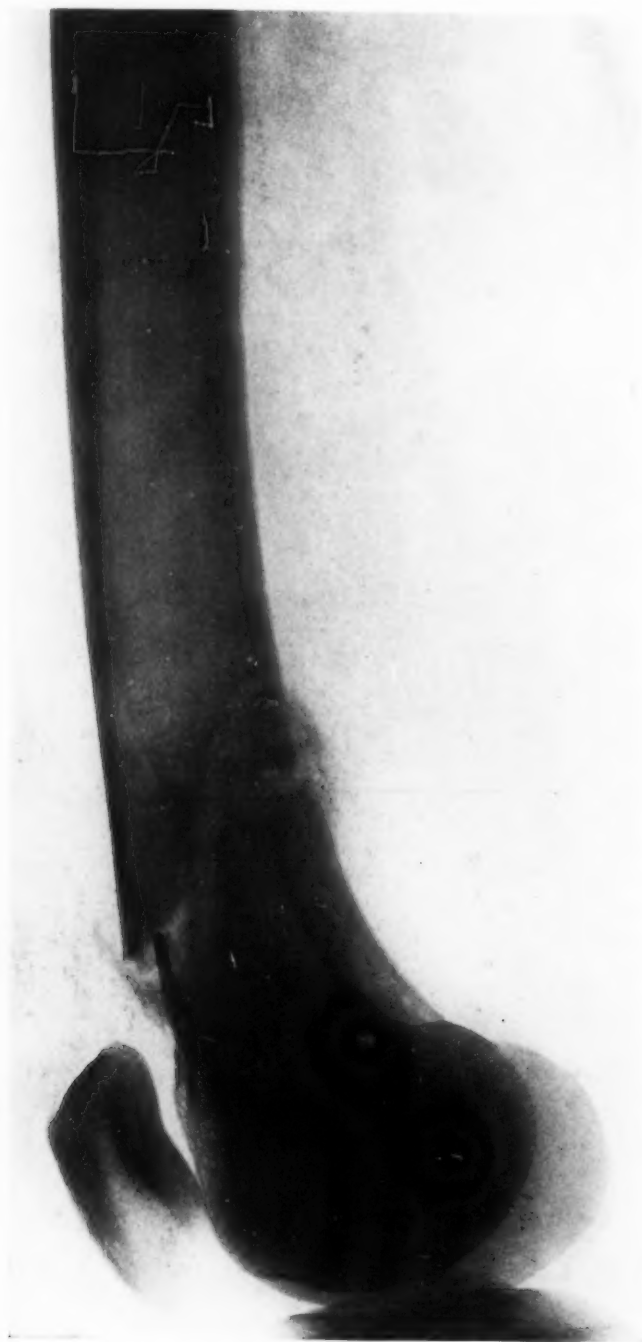


FIG. 6.—Case I. Correction of deformity secured by resumption of traction.



FIG. 7.—Case II. Separation of lower epiphysis of femur, lateral view.



FIG. 8.—Case II. Separation of lower epiphysis of femur; antero-posterior view.



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another interesting feature. When first seen, the fracture was four weeks old and a very considerable callus was palpated. There certainly seemed to be union. The observers who advised open reduction felt that the amount of union was too great for simple traction and also proposed the possibility that if traction could loosen the angulation it might pull the ends apart and thus create an even less desirable situation with the lower fragment pushing down into the popliteal space. Further, the vertical fracture line ran close to the tibial spines and it seemed possible that traction might separate a tibial spine already involved in the fracture line.

Personal experience with traction in cases of fractured femora during the war led us to believe that even after four weeks much could be done to correct the existing deformity without endangering the joint or over-correcting the position. The plasticity of callus up to a late stage in its healing is an old story, recently emphasized by the brilliant work of many surgeons during the war whose methods of applying traction and whose carefully founded belief in the efficacy of this method are now well known. The work of Sinclair, Blake, Pearson, and others during the recent war needs no discussion here, and this case is reported merely to add to the evidence that their methods are equally applicable in civil as well as in war surgery, and to stimulate others to abstain, when possible, from the more dangerous methods of open operative reduction.

*CASE II.—Separation of lower epiphysis of femur, F. P. B., Peter Bent Brigham Hospital, No. 23928 (Surg. No. 11964), male, aged fourteen years; occupation, school; seven brothers and three sisters living and well.*

*History.*—Born in Boston, general health always good, pneumonia five years ago, no previous accidents or operations, weight ninety-three pounds. Admitted to the Peter Bent Brigham Hospital the evening of February 22, 1920, following an accident while coasting. Shortly before admission, while coasting down a steep hill, lying supine on his "flexible flyer," he turned out sharply to avoid a man, and his sled slued sideways and ran him side-on into a brick wall, striking against his right side. The right leg was hanging over the edge of the sled and was hit by the wall, therefore, on the outer aspect of the knee. Following the accident he tried to walk, but it would not support him, although it could be freely moved and there was little or no pain. Because of this, he was accused by his friends of faking. However, he was carried home and then taken to the hospital, which was near by, on a sled.

*Examination.*—Physical examination in the Outdoor Department showed a very healthy appearing, well-developed and fully conscious boy with no abnormalities or disabilities beyond the local condition in the right leg. The right foot was everted, the patella entirely displaced to the external lateral aspect of the leg, and there was deformity with considerable swelling at the knee. The lower

leg was to some extent displaced anteriorly and externally on the femur, and the lower end of the femoral shaft could be felt in the popliteal space posteriorly. Curiously there was very little pain and motion was surprisingly free, although the leg felt flail-like and moved easily in abnormal directions. Gentle manipulation revealed a grating sound and without an anæsthetic manipulation was continued and a partial reduction of the deformity obtained. The leg was then placed in a pillow splint and the case admitted to the house.

The next morning the deformity described on admission to the Outdoor Department was still present. There was a diffuse swelling about the knee with a concavity just above the knee on the anterior-external aspect due to the external and anterior displacement of the leg on the thigh. Motion had now become limited and quite painful. Radiographs (Figs. 7 and 8) showed a separation of the epiphysis with dislocation of the lower fragment anteriorly and externally.

*Treatment.*—It was decided to attempt reduction under anæsthesia (gas-oxygen). When anæsthesia had been induced the foot was held between the operator's chest and his right elbow in order to get traction, thus leaving both hands free to deal with the local manipulation at the line of fracture. The patient being held by assistants, traction was exerted, the distal fragment pushed down and moulded into position by the operator's hands and then the knee sharply and fully flexed. The deformity had been reduced, but a suspected danger appeared, for the foot suddenly became white and no pulse could be made out in either anterior or posterior tibial arteries. At once the leg was extended when the foot became pink and full circulation returned, also the deformity to some extent. However, a second manipulation gave us what appeared to be perfect reduction without any evidence of the artery being pinched. A plaster cast was then applied to maintain the position of acute flexion.

The next day radiographs (Fig. 9) were taken to control the position and showed accurate apposition of the fragments, and from this time on convalescence was uninterrupted. February 25th the cast was cut away over the condyles for observation and to relieve pressure; March 9th, the fifteenth day after reduction, the cast was bivalved, the leg removed from the cast, and motion begun; this was painful at first, but was indulged in daily, and March 18th the cast was discarded and baking, massage, and active motion begun. Control radiographs taken March 15th showed no change in the position obtained at reduction. March 27th, thirty-three days following reduction, the patient was discharged, using crutches, bearing considerable weight on the leg, but with still some impairment of full extension.

Since discharge he has visited the Outdoor Department frequently, and some two weeks after leaving the hospital the use of crutches was discontinued. Radiographs taken April 18th (Figs. 10 and 11) showed that the fragments were still in good position. He was last seen there May 18th; at that time he was not using



FIG. 9.—Case II. Reduction of epiphyseal fracture by acute flexion of knee.



FIG. 10.—Case II. Condition of epiphyseal fracture after six weeks of treatment, antero-posterior view.

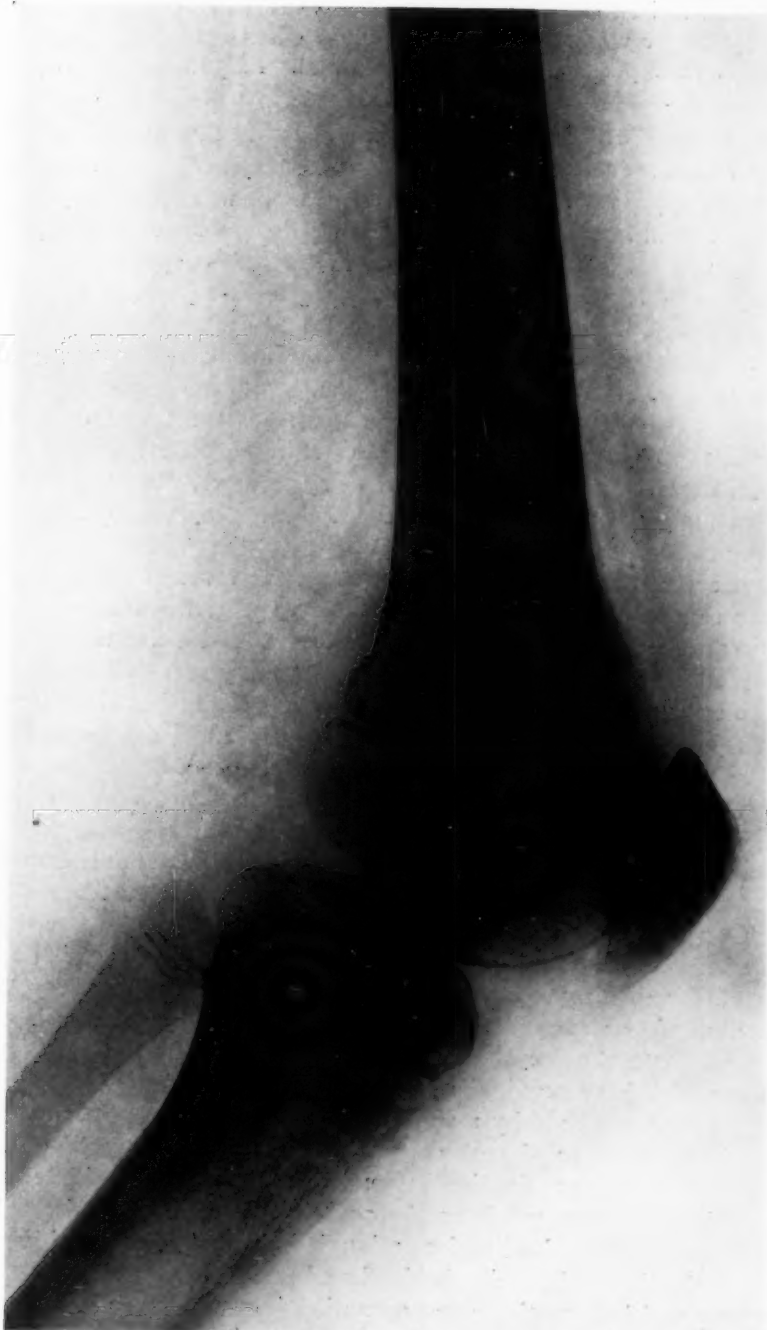


FIG. 11.—Case II. Condition of epiphyseal fracture after six weeks of treatment, lateral view.

crutches, full extension and almost full flexion were present in the knee-joint, he walked without a limp, and as far as subjective discomforts, complained of nothing abnormal. Palpation still revealed some callus.

*Discussion.*—Before taking up the methods of reduction of such fractures, it would seem wise to discuss the deformity in this case in relation to the force applied. Thus, in this case the force was apparently applied to the knee from before backwards, downwards, and inwards, and yet the deformity was towards the line of force. We have interpreted this as due probably to subsequent manipulation, though some peculiar application of force through lever action may have been present. However, it must be understood that the common deformity (Hilgenreimer<sup>7</sup>) is an anterior displacement of the epiphysis. The reason for this is probably because the origin of the gastrocnemius muscle is from the lower end of the diaphysis, not from the epiphysis (Drew<sup>5</sup>). Thus, once the epiphysis is loosened, no matter what the direction of the force, the gastrocnemius will eventually pull the lower end of the shaft into the popliteal space and leave the epiphysis anterior.

There are reported in the literature about 220 cases of this lesion and with the reports the methods of reduction vary between non-operative and operative methods. Among the operated cases, amputations and joint resection were done chiefly for compound fractures (MacAusland<sup>9</sup>), but open operation is also advised as the proper method in simple cases; MacAusland,<sup>9</sup> Kahn,<sup>8</sup> Demarest,<sup>4</sup> Binney and Lund.<sup>1</sup> Hilgenreimer<sup>7</sup> and Russell,<sup>12</sup> reporting separately a total of 214 cases, advise closed reduction and the putting up of the limb in mild or acute flexion for the simple cases. This policy would seem to be the wisest and there appears to us no good reason why such lesions in relation to the knee-joint should require operation more frequently than similar lesions about the elbow-joint. Our own case may have been a particularly simple one, but a review of the literature reveals that the deformity in this case is similar to that most frequently reported. Furthermore, such a study also reveals the fact that after reduction the position of mild or acute flexion is sufficient to maintain the position acquired in the reduction. Cases in the literature which have required reoperation because of inability to maintain the position acquired by manipulation were not, as a rule, put up in flexion. The after-care of such cases necessarily is endangered only by too long immobilization, fixation in flexion resulting in a stiff knee. To combat this, early removal from the acutely flexed position, depending somewhat on rapidity of callus formation, is indicated. We feel it is safe to advise reduction and fixation in the flexed position in all simple lesions of this type and believe that open operation is unnecessary and contra-indicated by a study of the cases already reported.

It is hoped that the exposition of such cases that might have come into the category of fractures best treated by open operation, but demonstrated



## NON-OPERATIVE TREATMENT OF FRACTURES

here to have been successfully treated by closed methods, will stimulate others to give the closed method a fair trial before resorting to the more dangerous and complicated method of operation.

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## EXSTROPHY OF THE BLADDER IN THE FEMALE

REPORT OF A CASE SUCCESSFULLY OPERATED BY THE EXTRAPERITONEAL METHOD

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SURGEON TO SISTERS' HOSPITAL

THERE have been so many and ingenious operations devised for the cure of exstrophy of the bladder that any further contribution to the operative technic would seem superfluous. However, in looking up the literature of this subject, I find that the very few successful operative cures were mostly in male subjects. I find not one single instance of a cure of exstrophy in the female by the extraperitoneal method. I venture, therefore, to report as an addition to the literature the history of one in a female of successful extraperitoneal transplantation of the ureters into the rectum. The technic used I evolved from the reported cases of London, of Australia, and Peters, of Toronto, both of whom transplanted the ureters into the rectum in male subjects. It is less difficult to transplant the ureters extraperitoneally in the male, because of the anatomical juxtaposition of the bladder and rectum; in the female the interposition of the uterus and vagina offers decided obstacles.

As late as 1890 it was the accepted teaching that no matter what operation was performed, a cure could not be obtained. It was figured that, although the defect in the abdominal wall could be corrected, it was impossible to create a sphincter muscle which would enable the bladder to hold the urine and the patient to voluntarily expel it. Then, too, no matter what the closure was, because of the congenital deformity the bladder itself was always very small at birth, and on account of the lack of muscular activity, not being obliged to hold the urine, there was always an undeveloped infantile bladder even in adults. In all of the plastic operations the mortality was exceedingly high and functional failure was usually the result even though the patient recovered from the operation. In 1851, however, an English surgeon, Mr. Simon, anticipated Maydl's ideas and endeavored to make an anastomosis between the ureters and the rectum, using a needle which he introduced into the ureter and the rectum, carrying silk ligatures which he knotted so tight that necrosis resulted and a fistula would occur between the ureter and rectum. This method was faulty, because, while some of the urine passed from the ureter to the rectum, a great deal of it passed down to the exstrophied bladder and the condition of the patient was not materially improved. Following this attempt was one by two other English surgeons who drew silk ligatures through the rectum and bladder, tightened them, permitting sloughing to take place and the establishment of vesico-rectal fistula. In these two cases, on account of a peculiar development of the peritoneum form-

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ing the pouch of Douglas, there occurred peritonitis because the peritoneum in these individuals came lower in the pelvis than ordinarily, and the needle passed through the peritoneum, infecting it. There followed other attempts to establish direct communication between the rectum and bladder, but were only partially successful; instead of eradicating the dribbling of urine, they simply modified it. In these attempts it is well to note that the operative mortality was high.



FIG. 1.—

In 1892 Maydl introduced a most radical departure from the previously tried methods; in fact, he revolutionized all surgical ideas concerning the treatment of exstrophy of the bladder. He introduced a method of transperitoneal anastomosis of the ureters with some portion of the intestinal canal, usually the sigmoid. He reported two cases in which he transplanted the trigone of the bladder with both ureters. His operations were successful, but were transperitoneal. On May 12, 1899, five years after Maydl's cases, Lendon, of Australia, blazed a brand new trail

and in the *British Medical Journal* of 1906 reported two cases in which he transplanted the ureters into the rectum extraperitoneally, one of which was partly successful. Simultaneously with Lendon, Peters, of Toronto, reported a case in a boy with good results, using practically the same technic as Lendon had used. Both Peters and Lendon worked independently of each other, one in Toronto, the other in Adelaide, Australia. Each is entitled to whatever credit there is in the evolution of the extraperitoneal transplantation of the ureters into the rectum in male subjects.

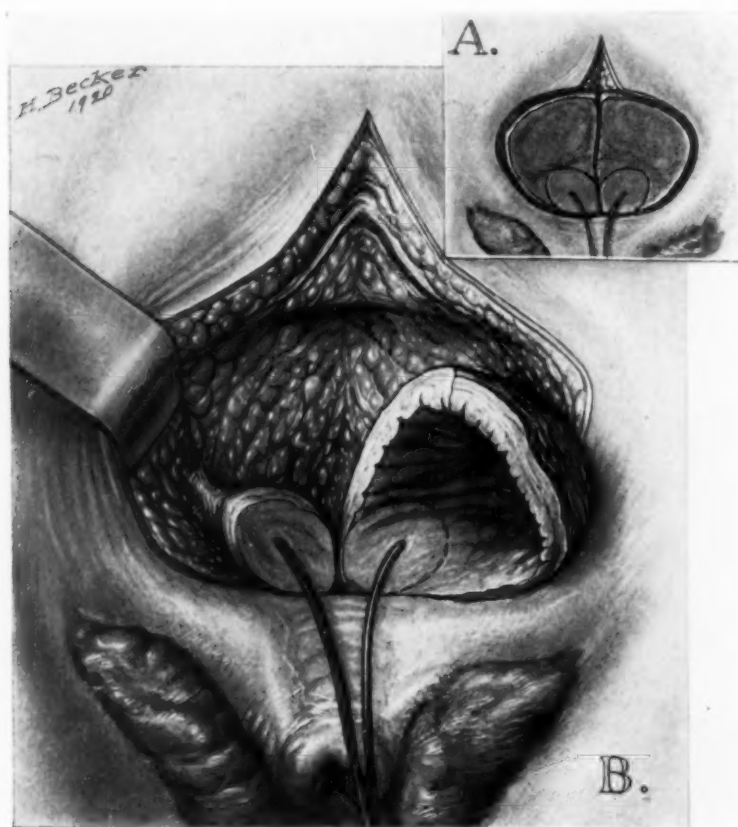


FIG. 2.—

*Case Report.*—Female, aged sixteen years, presents a classical congenital exstrophy of the bladder. Examination reveals the following conditions: (1) A defect in the lower abdominal wall, median line, about the size of silver dollar. (2) Absence of roof of urethra in whole extent. (3) Absence of symphysis pubis—separation about 2 inches (Fig. 6). (4) Bladder protrudes during straining or coughing. (5) There are no herniæ present, though hernia is said to frequently accompany exstrophy. There are no other congenital abnormalities. The bladder capacity is about two ounces; the roof of

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bladder is absent so that since birth there has been incontinence and hence constant dribbling of urine.

*Pre-operative Treatment.*—(1) Castor oil  $1\frac{1}{2}$  ozs. two days before operation. (2) Steam bath day before operation. S. S. enema at 4

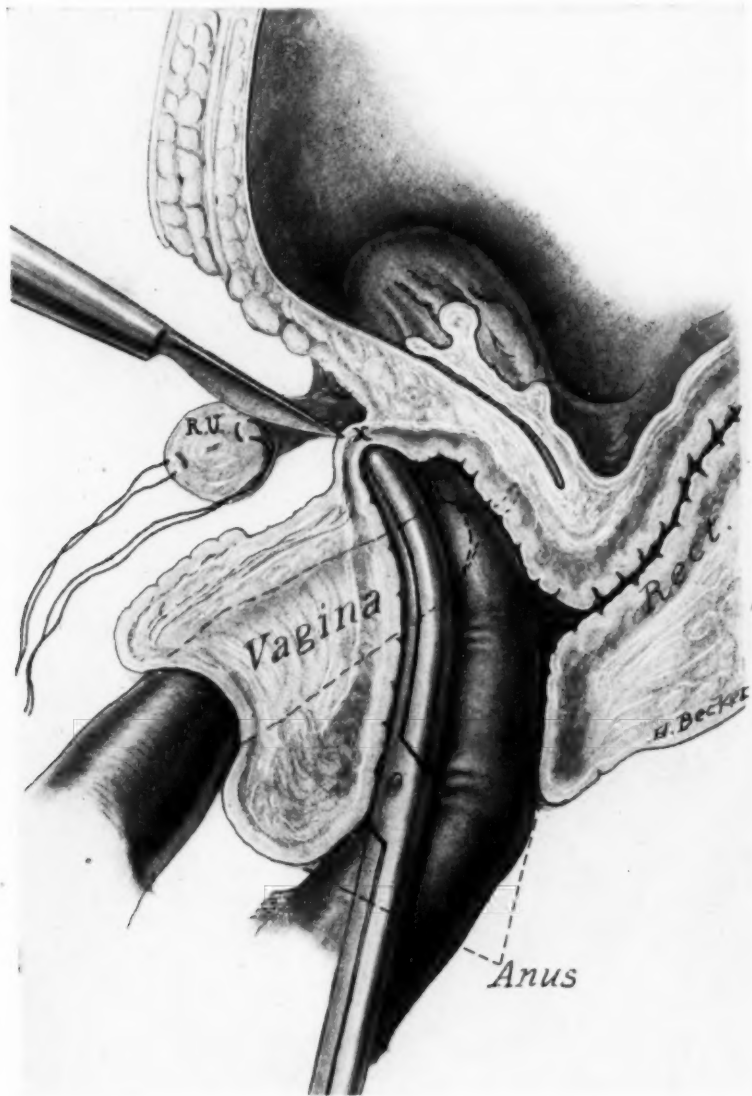


FIG. 3.—

A.M. and 6 A.M. day of operation. (3) Abdomen prepared as for laparotomy. (4) Morphine sulphate, gr.  $\frac{1}{4}$ , atropin sulphate, gr.  $\frac{1}{150}$ , hypo one-half hour before operation. (5) Ether anæsthesia. (6) Abdomen and bladder thoroughly iodized with 5 per cent. tincture of iodine. Date of operation, June 14, 1920.

*Operation.*—Introduction of catheters into the ureters for about 6 inches. This served a twofold purpose, (a) as guides, giving us definite knowledge of the positions and courses of the ureters; (b) as conductors of the urine from the ureters, rendering the opera-

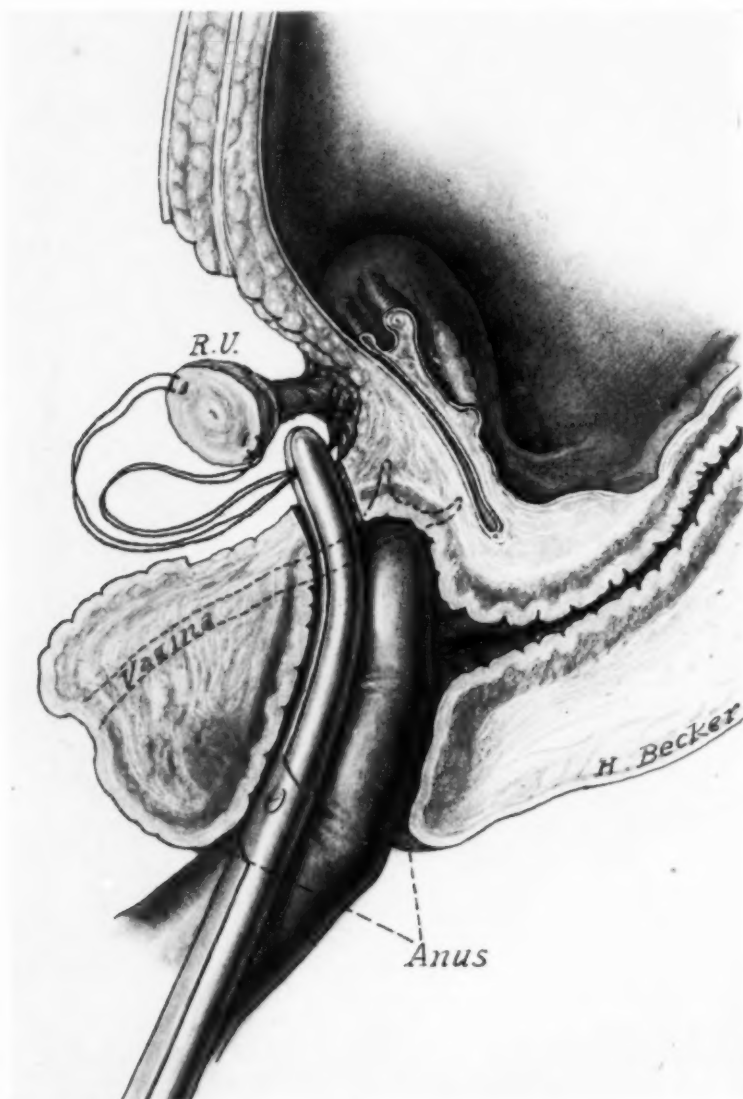


FIG. 4.—

tion field free of contamination. Beginning at the muco-cutaneous border of the bladder I made a  $2\frac{1}{2}$ -inch incision through the skin and fat, in the median line, down to the rectus fascia. The fascia was split the whole length of this incision. We here encountered preperitoneal fat and very little muscle in the lower portion of the



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incision. Beginning at the posterior wall of the bladder at the lower end of the incision, with gauze on the index finger, separation of the peritoneum from the bladder was attempted (Fig. 1).

This procedure was surprisingly easy. As this gauze dissection progressed I severed with curved scissors the attachment of the bladder with the abdominal wall at the muco-cutaneous junction around the whole circumference of the bladder. The gauze dissection was continued down to the ureters, which were easily distinguished on account of the catheters previously inserted. After freeing the bladder and isolating the ureters for about  $1\frac{1}{2}$  inches I split the bladder in the middle line down through the trigone (Fig. 2).

Beginning at this point I incised circularly the bladder about

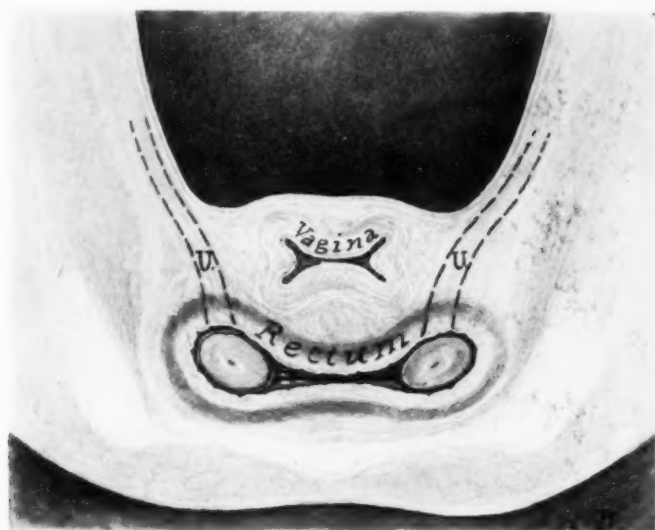


FIG. 5.—

$\frac{1}{4}$  inch away from ureter meatus, therefore, making a button or rosette of bladder with the meatus in the centre. In this manner I preserved the blood supply as well as the sphincter action of the ureter outlet. Then I inserted two mattress sutures of catgut into each rosette, leaving ends long. As an accurate guide and to facilitate this dissection, a finger in the bladder assisted materially. At this stage of the operation it was necessary for assistant to dilate the anal sphincter and introduce the index finger into the vagina and the middle finger into the rectum. Realizing that the index finger marked the limits of the vagina, we were sure that when we made our openings in the rectum we were not injuring the vaginal wall. It was not difficult, therefore, to know just where to attack the rectum. A long forceps was passed up into the rectum, the middle finger of assistant acting as a guide and pushed up to meet the operator's fingers from above. Between the operator's finger

and the assistant's middle finger were rectal wall and pelvic fascia (Fig. 3).

A small incision was made over the tip of the forceps and the latter pushed up through the rectum to grasp the long ends of catgut attached to the bladder rosette containing the ureter opening. The catgut with the ureter was then drawn through the opening made in the rectum and at completion of operation the ureters hung suspended for about  $\frac{3}{4}$  inch in the rectum, about 1 inch above anal sphincter (Fig. 4).

In transplanting these lower ends of the ureters it was attempted to prevent any kinking; that is, to leave the ureters to follow practically an even course, instead of upward towards the bladder, just reversed downward (Fig. 5).

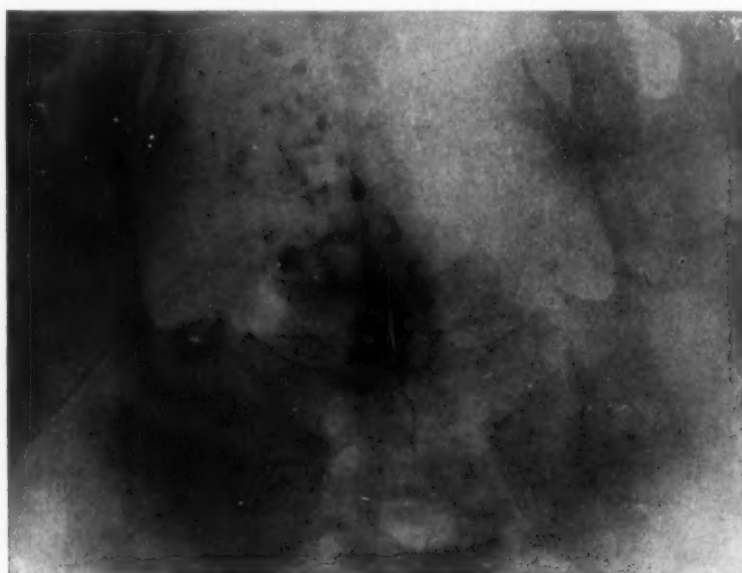


FIG. 6.—

Both ureters were treated in the same manner. The remaining part of the bladder was extirpated. Iodoform gauze was packed loosely down to the rectum on either side of vagina, to act, first, to stop the oozing which was considerable, and, second, to help prevent the ureters from slipping from the rectum. The abdominal wound was closed in the usual manner down almost to the pubes; just enough opening left to permit the two gauze strips for drainage and hemostasis. The catgut strands hanging in the rectum, attached to the rosettes, were brought outside the anus and kept taut by adhesive plaster, this to prevent slipping back of ureters from rectum. A piece of rubber tubing was finally introduced into rectum, dressings applied and the operation completed.

The post-operative treatment consisted of water copiously, urotropin, gr. v, every four hours and morphine when needed for pain

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and restlessness. The day following operation the dressings were saturated with blood, but there was no leakage of urine on them. The urine passed by rectum almost immediately after the patient was returned to bed. On the fourth day the iodoform gauze drain and the rectal tube were removed.

The temperature and pulse remained up (102° F.; 120 pulse) until about the ninth day after operation, when they became normal and so remained.

During the first two weeks the patient used the bedpan every hour, with fair sphincter control. After this time patient was out of bed and the demands became less and less until now she can go the whole day without bowel movement and sleep the night through.

Clinically there are no signs of pyelitis, no distress whatever. The patient is now at work in another city. She is happy and able to go about amongst people without any embarrassment whatever.

## GELATINIFORM CARCINOMA OF THE BREAST

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(From the Department of Pathology, College of Medicine, Ohio State University)

ACCORDING to Rodman, mucoid degeneration in carcinoma of the breast is of very rare occurrence. Of the various terms used to designate this change, that of gelatiniform carcinoma used by Billroth is probably the most satisfactory. These changes are associated with abnormalities of (1) epithelium, (2) connective tissue.

Carcinomata of the breast with abundant connective tissue framework (*i.e.*, scirrhus type) at times present great quantities of mucinous intercellular substances. The gross sectional appearance of these tumors is

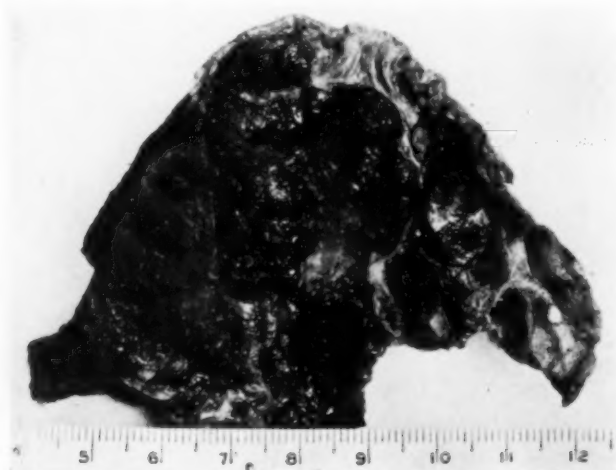


FIG. 1.—Cross section of gelatiniform carcinoma of the connective tissue variety.

much the same as that of ordinary scirrhus carcinoma, excepting that the fibrous tissue has been transformed into a gelatinous mass. This lends a peculiar translucency to the specimen which is seen in only one other condition—those adenomata with an abundant and œdematous stroma, the so-called “periductal myxo-sarcoma.” These can readily be differentiated from each other; (1) in the type of gelatiniform carcinoma under consideration the gland is usually atrophic with an infiltrating carcinoma, whereas the “periductal myxo-sarcoma” is the largest of mammary tumors and is a circumscribed growth with a delimiting capsule usually present; (2) upon section (Fig. 1) this type of gelatiniform carcinoma presents delicate cords of epithelial cells infiltrating the degenerated stroma, wherein the “periductal myxo-sarcoma” presents distinct lobulations traversed by cleft-like cavities.

## GELATINIFORM CARCINOMA OF THE BREAST

Under the microscope this type of carcinoma presents an epithelial growth and infiltration after the manner of scirrhus cancer. The extension appears to follow the tissue spaces. The stroma of the tumor stains poorly, is composed of connective tissue with relatively few nuclei, and rich in intercellular substances. The collagen fibrils are swollen and separated by fluid so that the cells present a water-soaked appearance. While the blood supply is usually described as being poor, the specimen seen in Fig. 2 shows a rather large number of mildly dilated vessels. It is possible that the resulting stasis indicates a disturbance that is responsible for the degenerative changes in this instance.

In carcinomas of the breast of the more cellular variety, that is, medullary type, the epithelium produces a mucoïd secretion. The gross

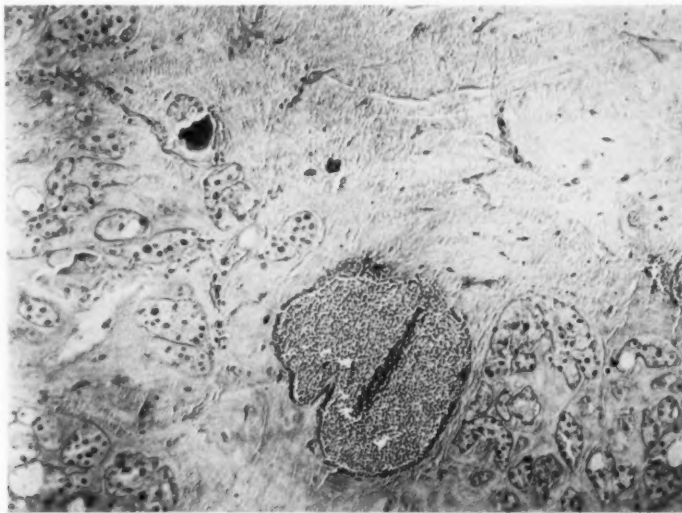


FIG. 2.—Showing mucoïd change in the connective tissue with mildly dilated vessel.

sectional appearance of these tumors presents cavities filled with a gelatinous substance, so that if a thin section is held to the light it resembles somewhat a section of simple goitre. This no doubt has been a factor in the origin of the term colloid carcinoma, which is a misnomer, since the material is colloidal only in appearance. Microscopically, much the same appearance is encountered as in the gross specimen. In the smaller cavities and acini the epithelial cells are enlarged and swollen. The lumen is filled with a homogeneous material. In the large cavities the epithelial cells are small, flattened, and appear degenerated. This degeneration is not necessarily to be interpreted as a conversion of the cell cytoplasm into the mucoïd substance, but is largely due to the pressure of the secreted material upon the cell within the confined spaces of the tumor.

Since the presence of gelatinous material is the evidence of retrograde

change in these tumors, one would expect them to be of slower growth, longer duration, and relatively less malignant. While these tumors are less malignant than other growths of the same cellularity, this apparently has no practical significance in view of the fact that both of the specimens forming a basis for this description were accompanied by lymphatic involvement.

It is also interesting to note that the presence of the mucoid substances in mammary cancer gives rise to a diagnostic sign first noted by Dr. W. S. Halstead. As described by him, it is characterized by a peculiar sensation imparted to the examining fingers when manipulating the breast. It is as if something within the gland had been burst or ruptured, resulting in a sudden forcing of fluid out into the intercellular spaces. The term "swish" probably best describes it to them who have not experienced the sensation.

*Summary.*—Gelatiniform carcinomas of the mammary gland are not of frequent occurrence. This gelatinous degeneration may occur in the epithelium or connective tissue. The elaboration of these mucoid substances is produced by an unknown cause, possibly associated with disturbances in nutrition. This change gives rise to the diagnostic sign of Halstead. This type of tumor is the less malignant of the ordinary types of carcinoma of the breast. While this fact is to be considered, it does not invalidate the other and more important factors entering into the prognosis.

The writer would here express his appreciation to Dr. Jonathan Forman for suggestions and photographs.

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TRANSACTIONS  
OF THE  
PHILADELPHIA ACADEMY OF SURGERY

*Stated Meeting held October 4, 1920*

THE PRESIDENT, DR. GEORGE G. ROSS, in the Chair

IMPERFORATE ANUS

DR. JAMES H. BALDWIN presented a child, two and one-half years of age, who in August, 1920, was brought to the Methodist Hospital with the statement that it had swallowed a penny some time before, which had not yet been recovered from the stools. Upon examination the child was found to have an imperforate anus with the rectum opening into the vagina through which the faeces were being regularly discharged. In a pouch of the rectum beyond this fistulous opening the coin was found. It was removed through the vaginal fistula. An operation for the formation of a normal anus was contemplated at a future time.

DR. A. P. C. ASHHURST remarked that Rizzoli, an Italian, many years ago (1856) devised an operation for this form of imperforate anus. He claimed that the sphincter of the anus is not at the opening in the anal region, but at the opening in the vagina. Therefore, he dissected the opening in the rectum free from that location, bringing the vaginal opening of the rectum down to the proctodæum.

DR. JOHN H. JOPSON had had the opportunity of seeing and operating on a number of cases of imperforate anus in his service at the Children's Hospital and elsewhere. The cases of rectovaginal fistula constitute the commonest variety. In these cases he had been accustomed to operate when they were first seen, and usually within the first few months of life. The operation is easy as the rectal pouch is near the surface of the perineum, and can readily be brought down and sutured to the skin. There is always a tendency to contraction of the new anus which requires subsequent dilatation to maintain its patency. He had not had the opportunity of following the hospital cases in later life, and of closing the vaginal fistula.

CHONDRO-SARCOMA OF PLANTAR SURFACE OF FOOT

DR. JAMES H. BALDWIN reported the case of a man, aged forty-five years, who had had a growth on plantar surface of right foot for twenty years. Up to two years ago it was about the size of his thumb. Since then it increased until it was the size shown in the photograph (Fig. 1), and he was compelled to walk on the side of his foot. The tumor was subcutaneous, had a capsule of its own, and was easily shelled out. When

removed the flexor tendons were exposed. The wound healed without complications. The excision was done September 2, 1920. The pathological examination made by Doctor Russell Richardson shows this to be a mixed tumor, a chondro-sarcoma, a form of tumor, while not uncommon, he had not seen or heard of in this location. They probably arise



FIG. 1.—Chondro-sarcoma of foot.

from embryonal cells capable of producing more than one type of adult tissue and may descend from one or all layers of the embryo. They usually represent two, or at most three, types of cells.

#### POST-OPERATIVE ENDOCRINE DEATH

DR. GEORGE G. ROSS reported the case of a woman who was admitted to the Methodist Hospital in April, 1920, on account of persistent vomiting. She had been ill about two weeks. The attack began with a severe chill lasting for about fifteen minutes, followed by persistent vomiting and bleeding from the vagina, lasting for two days. She did not pass any clots or shreds that indicated interrupted pregnancy. She also stated that at the very beginning of her attack she was jaundiced. Her bowels had been moving regularly. At the time of admission she complained of slight

## POST-OPERATIVE ENDOCRINE DEATH

epigastric pain. She had suffered from indigestion for years. She had no symptoms referable to the cardiac, renal, nervous, or pulmonary systems.

When admitted her temperature was 97°; pulse, 100; respiration, 26. She was a very weak, sick-looking, emaciated white adult of twenty-two years. The skin was hard and very dry, mouth dry and tongue red. The conjunctivæ were pale. The patient's general appearance was one of a moderately advanced case of inanition. The thing that was the most striking was the impression she gave of being very much in need of fluids. There were no abnormalities about the head or neck. The tonsils were chronically diseased. The heart was negative except for a slight acceleration. The lungs were negative. Abdomen was soft throughout, no marked rigidity. There was a mass about the size of a lemon in the right upper quadrant under the costal margin. It moved downward with respiration, but was not movable otherwise. On account of the extreme thinness of the abdominal walls the mass could be palpated from the loin, but could not be pushed into the kidney pouch. The abdomen was otherwise negative except for slight tenderness on deep pressure over McBurney's point.

*Blood.*—Red blood-cells, 3,920,000; white blood-cells, 15,000. Heart-beats, 80.

*Urine.*—1020, acid, trace of albumen, no sugar, no casts.

The treatment for the vomiting having failed and as the woman was rapidly growing worse, it was decided to open her abdomen, as it was hoped the tenderness over McBurney's point and the leucocyte count indicated a low-grade inflammation of the vermiform appendix, and its removal would control her only symptom, vomiting, and that the incision in the abdomen would afford an opportunity to establish the character of the tumor. Operation by Doctor Ross. Right rectus incision. Gall-bladder normal. Stomach normal, pylorus patulous, duodenum normal. The mass felt upon abdominal palpation was found to be the right kidney displaced downward and forward. It could not be replaced in the kidney pouch. The left kidney was movable. There were adhesions about the cæcum, the appendix was thickened and sharply angulated in the middle. The appendix was removed in the usual manner. The pelvis was inspected and found negative. The peritoneum had no fluid in it and the rectus muscle had the appearance of dried beef. The abdomen was closed without drainage.

The patient reacted well from the immediate effects of the operation. She was given 1000 c.c. of salt solution by bowel before leaving the operating room, and after returning to the ward was given continuous proctoclysis. She recovered from the ether with no vomiting and as soon as she asked for water it was given her. She did not vomit this. The first twenty-four hours after operation were uneventful and the patient retained all the fluid that was given her both by mouth and by bowel. At the end of this time her pulse and temperature rose rapidly from 100 and

99°, respectively, to 170 and 106°. She had passed both gas and fæces since the operation and had voided 50 ounces of urine. In spite of ice packs the temperature and pulse continued to rise and the patient died in a convulsion about thirty-six hours after operation.

Doctor Ross reported also the case of a woman who was operated upon in 1918 for repair of the cervix and intra-abdominal shortening of the round ligaments. Patient had had an attack of abdominal pain two weeks before her admission to the hospital. On the fourth day of this attack she had a severe uterine hemorrhage confining her to bed. There was a temperature of 101°. She vomited foul-smelling, brownish material. On the fifth day she experienced relief from the pain upon the passage of flatus and fæces as a result of an enema. The vomiting stopped immediately. A day before admission she had a recurrence of her symptoms. A diagnosis of incomplete intestinal obstruction was made, and for the second time her symptoms were temporarily relieved by an enema. An appendectomy had been performed twenty-two years ago.

Previous medical history, family history, and social history negative. Physical examination negative—except for a general tenderness of the lower abdomen, especially marked on the left side. Vaginal examination demonstrated a slight bloody discharge. The cervix was enlarged, soft, and the os dilated. The uterus was enlarged and tilted to the left and was fixed in this position. There was a left-sided pelvic mass the size of the fist which was tender to palpation.

Ten days after admission she was operated upon for a fibroid uterus and a sub-total hysterectomy was performed. This was attended by considerable difficulty, owing to the fact that the bladder was adherent to the fibroid uterus in front and sigmoid behind. The left ovary and tube were badly diseased and were adherent in the pelvis behind the broad ligament. It was necessary to dig the ovary out of its adherent bed. There was little or no hemorrhage. The wound was closed without drainage. The operation took one hour and a half. At the termination of the operation her pulse was 135; skin was dry and warm; color of mucous membranes, pink. A few hours after she was returned to her room the temperature began to mount rapidly until it reached 104  $\frac{2}{5}$ °, ten hours after operation. An ice pack of two hours reduced the temperature 2 degrees. Within fifteen minutes after its discontinuance the temperature had reached 105°. Seven hours later the temperature was 107° and the pulse uncountable. Patient became unconscious and died. Patient developed slight distention. There was active peristalsis. She passed flatus and fecal matter as a result of an enema.

This death is one that is compared with that which occurs in the toxic goitre. Doctor Ross believed these two cases to be deaths due to chemical toxæmia, a result of hyperactivities of the ductless glands, probably of the adrenals.

In the second case it is possible that the traumatism caused by the

#### ACUTE PANCREATITIS COMPLICATING PREGNANCY

removal of the ovary may have liberated a chemical toxin which, being driven into the circulation, might account for the subsequent events.

DR. H. R. OWEN said that two or three years ago, during the month of August, he operated on a child at the Orthopaedic Hospital on an excessively hot day. The temperature in the operating room must have been over 100°. The operation was tendon transplantation—an operation which should have been postponed until a cooler day. During the operation he noticed that the patient became very flushed and the skin felt very hot, and was not perspiring. The child's temperature was taken and found to be 106°. Pulse was running between 140 and 150. Both temperature and pulse had been normal previous to the operation.

He believed that this child suffered from a heat stroke. The child was very ill for about forty-eight hours, but recovered.

The moral this case taught him was never to operate on any case, excepting an emergency, on an excessively hot day.

He did not know whether Doctor Ross's two cases were in the same category as this case, but when he stated that one of his operations had been performed in August, Doctor Owen recalled this case of heat stroke, which he feared for twenty-four or forty-eight hours was going to terminate in a fatality.

DOCTOR ROSS rejoined that he was familiar, as all are, with the sun-stroke which may occur during operation, having seen it develop with the patient on the table. These two women complained of great heat while their extremities were cold; there was a peculiar expression about the face and there was semiconsciousness. The first woman died with convulsions. He had been groping for some plausible explanation of the phenomena presented and had thought of the endocrine theory only because it seemed to him to be about as reasonable as any other.

#### ACUTE PANCREATITIS COMPLICATING PREGNANCY

DR. W. P. KROGER (by invitation) reported the following case of acute pancreatitis complicating pregnancy on account of its extreme rarity. The patient, a married woman, twenty-four years of age, and seven months pregnant, was admitted to the Lankenau Hospital in August, 1920, to the service of Dr. George Ross. Her chief complaint was acute pain in the upper left abdomen. Her health had been very good until two weeks before admission to the hospital, when she took a long automobile ride. Following the trip she began to notice mild, generalized, abdominal discomfort. She felt tired and vaguely ill. Two days previous to entering the hospital she developed sudden pain in the upper left abdomen. This pain gradually became more severe and in twelve hours it was very acute. She then began to vomit and continued to vomit frequently and profusely. At first there was a little blood in the vomitus which she thinks may have come from her throat. Later the material became dark green or brown. No fecal odor to this material. No purgative was given and several



enemas gave only a slight result. The pain continued to be severe, she became very weak and was sent to the hospital.

There was nothing of importance in the past medical history. Her menstrual history was negative and she had one healthy child.

Examination revealed an obese adult. Skin was cold and clammy and she was evidently in a condition of shock. The pulse was weak, running about 160. The temperature was subnormal, about 97°, and the respirations were 36. Her blood-pressure was 96 systolic and 64 diastolic. The head was normal. Face was pale and the tongue was heavily coated. The neck was negative. Aside from rapid rate, the heart was in good condition. The lungs were clear. The abdomen was distended with a pregnant uterus. There was moderate tenderness throughout the upper abdomen, especially on the left of the midline. No rigidity was noted and no masses were felt. Peristalsis was diminished. The uterus was enlarged, hard, slightly tender and freely movable. The vaginal examination was negative. The extremities were cold.

A blood count showed 80 per cent. of hæmoglobin, 5,000,000 red cells, 30,000 white cells, and 90 per cent. of polymorphonuclears. The urine contained no sugar, a slight amount of acetone and diacetic acid, and a few granular casts.

About six hours after her admission the patient complained of severe pain in the lower abdomen and she suddenly aborted a dead fœtus with the membranes intact. Following the abortion she became much weaker, her temperature arose to 103°, and the pulse became very rapid. Her condition continued from bad to worse, she became cyanotic, and twenty hours after entering the hospital she died.

An autopsy was performed. Upon opening the abdomen a considerable amount of dark brown fluid was noted, the "beef broth" fluid of pancreatitis. The stomach and upper intestines were dilated. The lower ileum was markedly constricted. The omentum contained many white areas of fat necrosis. The pancreas was acutely inflamed and showed almost total destruction by necrosis. The liver, gall-bladder, and other abdominal organs were apparently normal. The microscopic sections showed acute suppurative hemorrhagic pancreatitis and fat necrosis of the omentum.

When making a diagnosis of this case a number of conditions should be considered. Chief among these are acute cholecystitis, acute pancreatitis, perforated peptic ulcer, and acute intestinal obstruction.

Doctor Gatewood, of Chicago ("Surgical Clinics of Chicago," vol. iv, No. 4, page 801, August, 1920), reports a case similar in some respects to this one, but in his case the initial symptoms occurred directly after pregnancy. He operated upon his case, draining the pancreas and the gall-bladder. His case recovered. He advises operative interference in all cases. Other than this no similar cases could be found in the literature.

Dr. George G. Ross said that this woman was sent into the hospital



## GUNSHOT WOUND OF THE SHOULDER

with the diagnosis of acute perforation of the stomach or duodenum. I could not satisfy myself that such was the condition. The woman's pregnancy obscured the situation. He was unable to make a diagnosis, but was able to stay his hand, and the post-mortem proved the wisdom of not doing anything, for the whole pancreas was sloughed away.

## ISOLATED FRACTURE OF THE LESSER TROCHANTER OF THE FEMUR

DR. E. B. HODGE reported the history of a woman, aged seventy-four years, who was admitted to the Presbyterian Hospital with a diagnosis of "broken hip." She had become dizzy and fallen on her left side. There was tenderness over inner upper left thigh, slight eversion and no shortening. X-ray showed a fracture of the lesser trochanter. The leg was treated by light extension with the thigh in moderate flexion. X-ray one month later showed satisfactory callus. Ashhurst, "Principles and Practice of Surgery," Second Edition, quotes Metcalf as having in 1915 collected seventeen cases of isolated fracture of the lesser trochanter.

DR. GEORGE G. ROSS said that he had seen two cases of fracture of the lesser trochanter, both in baseball players. The injury had occurred in their effort to recover their balance after having missed the ball. Both were dressed with partial flexion.

## ISOLATED FRACTURE OF THE TUBEROSITY OF THE ISCHIUM

DOCTOR HODGE also reported the case of a man, aged forty-five years, who was admitted to the Presbyterian Hospital in March, 1920. He had fallen 40 feet from a tree, landing full on his buttocks upon a macadam roadway. There was considerable shock. No gross injury could be found except a tender swelling in the region of the right tuberosity of the ischium. X-ray showed fracture at this point only. Besides the rarity of the fracture, a point of interest was the high degree of paresis of bowel and bladder. Early in the case the diagnosis of rupture of the bowel had to be seriously considered. There was ultimate union and patient walked out of the hospital in seven weeks. He has, however, not yet recovered from the effects of the shock to his nervous system.

W. D. HAINES (ANNALS OF SURGERY, February, 1920), in recording an instance of isolated fracture of both tuberosities, states that search of the literature showed no record of an uncomplicated case. Ashhurst, *loc. cit.*, states that the tuberosity has been detached by muscular violence. Haines properly emphasizes the importance of rectal approach for diagnosis and reposition of fragments.

## GUNSHOT WOUND OF THE SHOULDER

DR. JOHN H. JOPSON presented a woman seen at the Presbyterian Hospital. She had been shot the previous evening at close range by a 38-calibre revolver, the bullet entering on the left side at the anterior border of the deltoid muscle, near the apex of the axilla, and lodging in the

bone at the level of the base of the greater tuberosity. There was no evidence of vascular or nerve injury. The usual operation of *débridement* was done. The ball had traversed the deltoid muscle and lodged in the bone. It was removed from this bed, and found to be partially wrapped in a portion of cloth from the patient's dress. Cultures were taken from this. Owing to the length of time elapsing since the wound was received, twenty hours, it was not sutured, but packed with Dakin gauze. This was removed at the end of twenty-four hours, and the Carrelling of the wound begun. Cultures and counts were made from the wound on the second day. Laboratory reports were as follows: From the cloth wrapped about the bullet two organisms were obtained, *viz.*, a Gram-positive bacillus unidentified, and colon bacillus. From the wound two days later, a Gram-positive bacillus, non-spore bearing, identified culturally as the Hay bacillus, and present in the proportion of 1.5 organisms per field. With these reports the completion of the suture by the delayed primary method, was undertaken with complete confidence. On the third day, after anæsthesia and complete preparation of the field antiseptically, including iodine, the deep structures were approximated with chromic catgut, and the skin edges with silkworm-gut. No drainage. Three times was the patient anæsthetized. Primarily with ether; the Dakin packing was removed while under Savariaud, and the final closure was made under nitrous oxide gas. The case was a demonstration in civilian practice of the applicability of the lessons learned in many thousands of cases during the war. The result was a perfect one, and the period of disability negligible after her discharge from the hospital twelve days after injury.

#### MIXED TUMOR OF KIDNEY

DOCTOR JOPSON also reported the history of a little girl of three years, and exhibited the specimen removed. The child had a negative family history, and enjoyed good health until six weeks before her admission to the Presbyterian Hospital. At this time she began to be peevish and fretful. One week before admission her mother while lifting her noted the presence of a tumor in the right side of the abdomen. Examination of the urine showed the presence of red blood-cells, and the child was seen to be anæmic.

On admission to the hospital she was in fair general condition. The blood report showed red blood-cells, 3,650,000; whites, 10,085; hæmoglobin, 48 per cent. The urine report was as follows: Specific gravity, 1022; reaction, acid; sediment, slight flocculent; albumen, very faint trace; sugar absent; red blood-cells in small amount, and white cells more numerous. A large tumor was readily detected on the right side extending several inches below the costal margin, and visible, palpable and movable. No evidence of metastasis could be found. The tumor was evidently of rapid growth, as the mother was an observing woman, a



FIG. 1.—Supracondylar fracture of femur.



FIG. 2.—Imperfect reduction by traction tongs applied to the tuberosity.

## MIXED TUMOR OF KIDNEY

trained nurse, and the widow of a physician, and it had only attracted her attention a week before.

Four days after admission a transperitoneal nephrectomy was done through a right rectus incision. The large tumor was adherent to the subperitoneal structures, and ruptured while being lifted and separated. Some thick gelatinous degenerated tumor content escaped. There was no bleeding to speak of, and the operation was simple of execution. There was considerable shock immediately following removal. The wound was closed without drainage. Reaction was rapid, and convalescence smooth.

Two weeks after operation the patient was subjected to radium treatment by Doctor Newcomet at the Oncologic Hospital. After which she was sent home in good condition. For about six weeks she seemed in fine health, gaining weight, of good color, playing, and in fine spirits. She then again became peevish and languid, her appetite failed, and she complained of pain in the abdomen. There was no definite demonstrable sign of local recurrence, although this was suspected. There was a short period of acute illness, with vomiting and collapse before death which occurred on September 8th, two months after operation, and a little longer time after detection of the condition.

The pathological report by Doctor Speese is as follows:

Specimen consists of a kidney which measures 16 x 8 x 7 cm. The external surface is smooth. For the most part the growth is mushy and presents a soft reddish-white mass which in places has undergone necrosis and shows much hemorrhage. On cross section a portion of the kidney cortex measuring 1 x 3 cm. in diameter is apparent. Elsewhere the kidney tissue is destroyed. Microscopic examination shows a very cellular growth composed of small cells, spindle in shape, which are closely packed together, particularly in the region of the blood-vessels, the walls of which seem to be formed of tumor cells. The stroma in this region is scant, but elsewhere is well developed. The sarcomatous elements predominate, but a few atypical gland formations are seen, which indicate that the growth belongs to the *mixed tumors*. Extensive areas of necrosis and hemorrhagic infiltration are encountered. The kidney tissue which persists is the seat of hyaline degeneration and cloudy swelling.

The fatal outcome of the case, illustrating, as it does, the exceptional malignancy of this type of tumor, corresponds with what we have observed in all the cases coming under our attention. Albanan could find but seven cases in which a child survived operation longer than three years. The classical case of Abbe, which carefully traced from childhood to adult life showed no recurrence, illustrates the very rarely obtained cure, and at the same time demonstrates that this is within the realm of possibility.

A second case was reported by Doctor Jopson, a tumor of the kidney occurring in an adult male, aged forty-eight years. The tumor had existed at least eight or nine years. It was discovered at that time by a physician during the course of an examination to determine the cause of vague symptoms in the way of discomfort in abdomen and back. The surgeon at that time informed him he had a floating kidney. The symp-

toms, which he describes as a heaviness in the right iliac region, and pain in the lumbar and sacro-iliac regions, have increased somewhat in severity, and the tumor has probably increased in size. Moreover, he has become somewhat neurasthenic concerning himself and his condition. He also describes a bloated feeling and has some diarrhœa. His general health has been good, and he has worked steadily at his trade of inspector of air brakes. He was referred to the Presbyterian Hospital by Doctor Steinmetz.

His family and previous history aside from the above are negative. His general condition is good. Weight is 145 pounds. In the right side of the abdomen is a large tumor, occupying the hypochondriac and lumbar regions, the size of a child's head. Owing to the relaxation of the abdominal wall, it is visible as well as palpable, moves with respiration, and with the patient in the left lateral decubitus falls to the left side. Bimanual examination shows extension to the loin space. It is insensitive, of smooth surface, and semi-cystic in consistency.

X-ray examination by Doctors Newcomet and Steinmetz shows the ascending colon displaced far to the left, and the stomach pushed upward. They believed they could outline the right kidney separate from the tumor. Urine report: Specific gravity, 1016; sediment, none; albumen, none; sugar, none; microscop., 2" ? and few epithelial cells; very few hyaline casts. Functional P.S.P. test, (1) Amt. 40" P.S.P. 15. (2) Amt. 60" P.S.P. 25.

Blood examination: Red cells, 4,810,000; leucocytes, 10,500; hæmoglobin, 91 per cent.

*Operation*, September 3, 1920: Long right rectus incision from ribs to below navel. Palpation shows opposite kidney normal, and no intraperitoneal pathology. Ascending colon displaced by tumor much to left. The thin external layer of the ascending mesocolon was split. Numerous perinephric adhesions were divided, the tumor was lifted out of the abdomen, and found to spring from the lower pole of the kidney, which was fused with it. The ureter was clamped, divided, and cauterized after ligation. Two large clamps were applied to the proximal side of the vascular pedicle, one to the distal side, the pedicle was divided, and the tumor removed. Vascular adhesions and pedicle were ligated. The posterior peritoneum was sutured. The abdominal wound was closed in layers, using chromic catgut. No drainage. After operation the patient did well for three days. He could not void, and was catheterized at regular intervals, passing large amounts of urine of normal character. On the second night, being uncomfortable, he sat up twice on the edge of the bed in an effort to void. On the evening of the 5th of September he vomited, and this persisted through the night and the following day. The patient was partially collapsed with thready pulse, cold skin, and seemed very ill. The dressings were dry. Stomach washings gave temporary relief. In the afternoon inspection of the wound showed that the





FIG. 3.—After application of tongs and traction to condyles of femur.



FIG. 4.—Showing further correction by elevation of tongs and traction after partial reduction.



FIG. 5.—The fracture after final consolidation—all apparatus removed.

deeper stitches had given away, and there was nothing but skin stitches holding. The wound was reopened, the intestine covered by omentum reduced, the peritoneum found perfectly clean and sterile. The wound was resutured under gas, and the patient pronounced himself a short time later as feeling relieved, as indeed he was. His condition at once improved, all symptoms of peritoneal irritation disappeared, and he gave no further cause for anxiety.

Report on specimen by Dr. John Eiman is as follows:

Gross: Kidney and tumor attached to the lower pole. The kidney and tumor weigh 1380 grams, and measure 21 x 11 x 8.8 cm. The tumor mass is roughly spherical, and measures 14 cm. in diameter. The lower half of the kidney is split in the median line and the tumor is wedged in the kidney tissue. The kidney is pale purple in color and fairly firm in consistency. The tumor is reddish yellow in color, elastic in consistency and feels like a huge cyst. The surface of the tumor is covered diffusely with fibrous adhesions and shows numerous large distended vessels and a network of finer vessels. On pressure over the tumor there exuded from the renal vein a few c.c. of dark red blood. The renal veins show no gross lesions.

Specimen was opened after hardening for about two weeks. On cross section it showed a solid tumor mass attached to the lower pole of the kidney. The tumor was surrounded by a definite capsule which varied in thickness from 1.5 to 2.5 cm. In that portion of the capsule which separates the kidney tissue from the tumor were seen huge irregular blood-channels which in some places measure 2 cm. in diameter. The tumor was elastic in consistency, dirty grayish yellow along the periphery, and bluish black in the centre. (The dark discoloration probably due to faulty fixation.) Roughly in the central portion of the tumor is a stellate core made up of fairly dense fibrous tissue. Microscopic Diagnosis: Hypernephroma. Grawitz type.

#### SUPRACONDYLOID FRACTURE OF FEMUR

Dr. JOHN H. JOYSON reported a case of supracondyloid fracture of the femur complicated by fracture of the tibia and fibula on the same side, treated by tongs extension. He exhibited lantern slides showing stages of reduction of the fracture. The patient, a male aged forty-two years, injured in a railroad accident and admitted to the Presbyterian Hospital, had the lesions mentioned, and additional complication to treatment in the shape of abrasions around and above the knee, at the points where it was desired to apply the tongs extension. He was therefore somewhat in the position of a battle casualty, as the chances of infection were materially increased by applying the extension at these areas. The skiagrams showed an oblique fracture about 4 inches above the articular surface, the lower fragment rotated backward and pulled upward in the manner common to this fracture. The end of the upper fragment was in contact with the upper margin of the patella. There was an oblique fracture of the tibia, and a transverse fracture of the fibula, in fair position, in their lower thirds.

In view of the abrasions, tongs traction was first applied to the tibial tuberosity, in accordance with Blake's teaching, and twenty pounds weight applied, the knee flexed and supported in a combination of Thomas and Cabot splint to fix the fracture of the tibia and fibula. This

## SUPRACONDYLOID FRACTURE OF FEMUR

treatment was ineffectual in bringing about reduction, although some separation of the fragments was obtained. Seven days after injury, the skin wounds having healed, the tongs were applied above and anterior to the axial centre of the condyles, and twenty-four pounds weight applied. A few days later another X-ray showed reduction almost complete. To assist in overcoming the backward displacement and downward pull of the gastrocnemius muscle, upward traction by a canvas cuff above the knee with a pull of eight pounds was used. Later the line of extension through the tongs was raised to lift the lower fragment into line with the shaft of the femur. Slight lateral displacement amounting to one-half inch persisted. Tongs were removed after six weeks. Knee exercise was hampered beyond that obtaining in the ordinary type of similar cases by reason of the complicating fractures of tibia and fibula. At the end of eight weeks, when apparatus was removed, there was limitation of knee movement to 25 degrees. This improved rapidly, and at time of discharge, nine and a half weeks after the injury, it was inconsiderable.

Doctor Jopson said that the suspension method of treatment of fractures, which is sometimes known on the continent as the American method, has largely displaced the operative treatment of fractures of the upper and lower extremity alike. It renders it unnecessary in a very large percentage of fractures which resisted reduction by the old methods, and which were therefore considered as suitable cases for plating, slide-grafting, or open fixation by other methods. Its advantages, now generally recognized, are (1) that it secures relaxation of the deforming muscles of the fractured member, and this relaxation, produced in part by posture, when increased by a combination with traction applied by one of several methods, permits the bone fragments to fall into their proper relation. (2) It permits of mobilization of the joints of the part from the moment of beginning treatment, and thus insures prompt recovery and preservation of function, without the atrophy of muscles, and crippling adhesions which only too frequently were the bane of the surgeon who treated fractures by the non-operative or operative methods. (3) Permitting of functional rest, it also permits change of posture and relieves pain. (4) Circular constriction of the limb is avoided, and (5) in all cases of compound fracture, infected or clean, access to the wound and ease and comfort of dressing are facilitated to a degree possible by no other means. The recognition of the advantages of continuous traction by weight extension, of skeletal traction as contrasted with the Buck's extension or strips glued to the skin, naturally followed the general adoption of the suspension method in large series of cases during the war. It appears, however, that a considerable number of surgeons have been slow to give up the practice of open operation in certain of the rarer fractures, and that they would profit by a careful study of the papers of Blake, Lyle, and their assistants and associates, and would perceive the possibility of a wider application of the principles which they have emphasized. In

this connection we would like to present the following series of slides showing the possibilities of treatment in supra-condyloid fracture of the femur.

FRACTURE OF TIBIA AND FIBULA WITH NON-UNION TREATED BY OPEN OPERATION AND TONGS EXTENSION

DR. JOHN SPEESE showed the X-ray plates of a fracture of the tibia and fibula which he thought would be of interest in conjunction with Doctor Jopson's remarks. The fracture of six weeks' duration was so firmly fixed and overlapped that open operation and mobilization of the ends was necessary. The wounds were closed, tongs extension applied to the malleoli, and the leg placed in a Thomas splint. A second X-ray taken five days later showed satisfactory reduction, the slight eversion of the lower fragments was readily corrected by changing the line of extension.

While the use of tongs extension is admirably adapted to the correction of such fractures of recent occurrence, it has a distinct advantage after open operation has been resorted to. Its use in such cases insures reduction and avoids the more prolonged and dangerous operations of fixation of the fragments by metal plates or bone grafts.

DR. GEORGE P. MULLER said that a number of cases had been treated by "tongs extension" in his wards during the past few months and they have been much pleased with the results. The method seems to be without serious inconvenience to the patient, only in one case did any trouble occur, and in this some skin necrosis resulted from improper introduction of the tongs. He believed that the method will be of particular use not only in curing deformity as seen in the case reported by Doctor Jopson, but also in difficult cases of comminuted fracture in the lower third of the leg. He thought it would be simpler and more satisfactory to use the metal plate in cases of fracture high in the shaft of the femur.

DR. GEORGE M. DORRANCE said that he had had some experience with the use of tongs in Evacuation Hospital No. 1. Most of the fractures where he used the tongs were compound. In the ordinary case he does not find it necessary to use the tongs, if the Thomas splint is correctly applied. In supracondylar fractures, he had used the tongs in three cases. It has the added advantage that one can flex and extend the leg, thus avoiding the stiff knee-joint that commonly follows the old methods of treatment.

DOCTOR MCKNIGHT said that in the use of the Steinman pin he had had few infections. Riedel reports forty cases of fracture of the femur and lower leg treated in this manner, and in only four did he have delayed healing of the pin openings, one for four months and the others for fifteen weeks, and these were in alcoholics. The Groves modification of the Steinman apparatus is more efficacious when the extension is to be applied to the cancellous end of bones. This consists of a small triangular plate with three pins a quarter of an inch long. They are in-



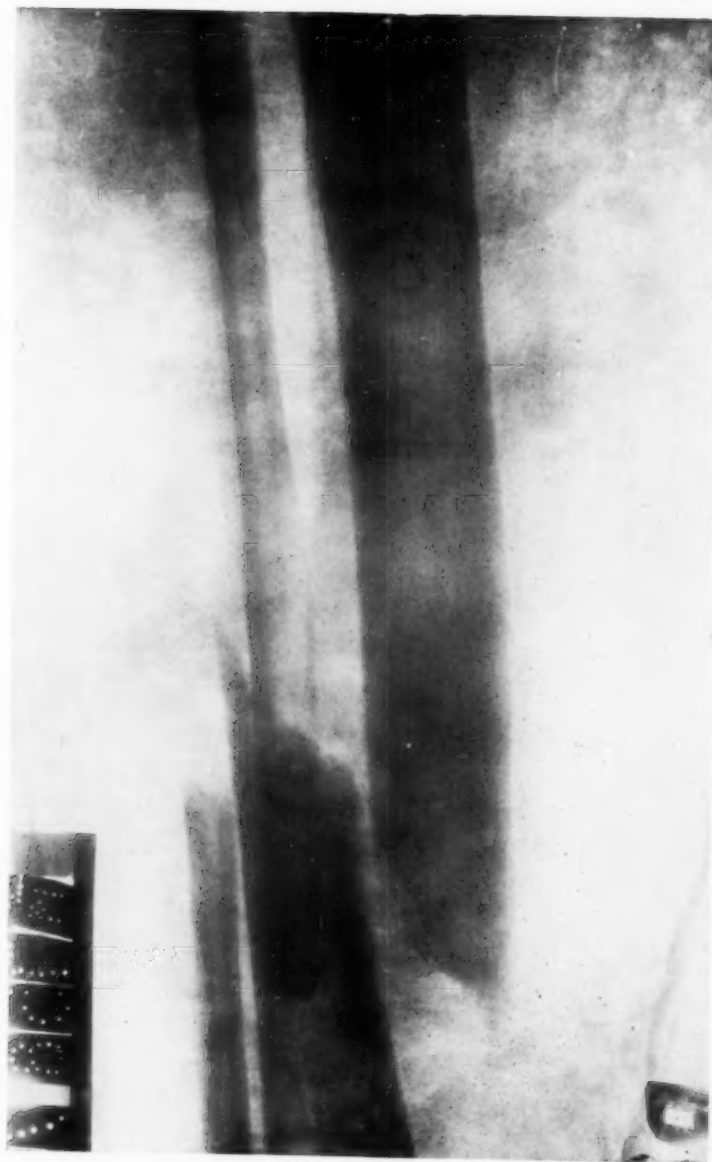


FIG. 1.—Fracture of tibia and fibula before application of tongs.

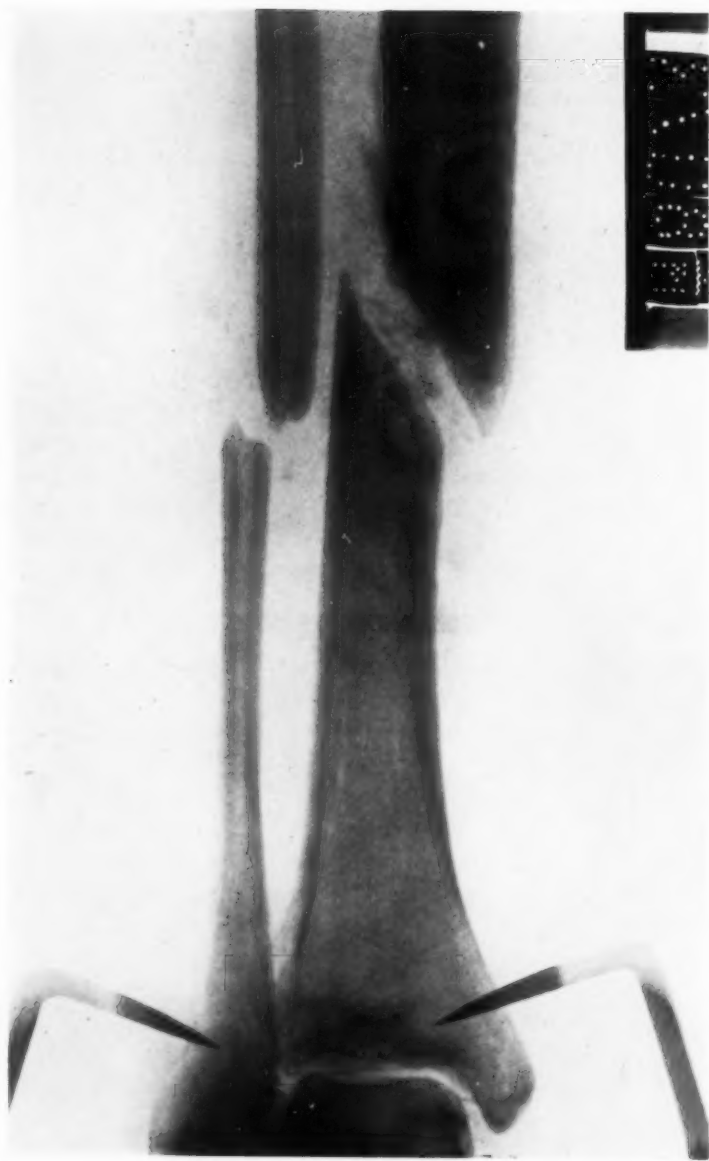


FIG. 2.—Reduction by tongs extension.

## CONGENITAL STENOSIS OF THE COLON

serted into the condyles and are less apt to tear out or injure bony tissue than the tongs. In fracture dislocations of the ankle with anterior displacement a partial tenotomy with direct bone extension is the best treatment in this rather difficult deformity. In applying the tongs the skin should be retracted upward to prevent direct pull on the soft tissues. This method of fracture treatment is not brutal nor so painful as indirect traction of twenty or thirty pounds pull on the muscles, tendons, and ligaments as occurs in Bucks' extension.

### SUSPENSION TREATMENT IN FRACTURE OF THE PELVIS

DR. JOHN H. JOPSON exhibited a slide (Fig. 1) illustrating the application of suspension apparatus as devised and used on Doctor Jopson's service by one of his former assistants, Dr. Douglas P. Murphy, for treatment of frac-

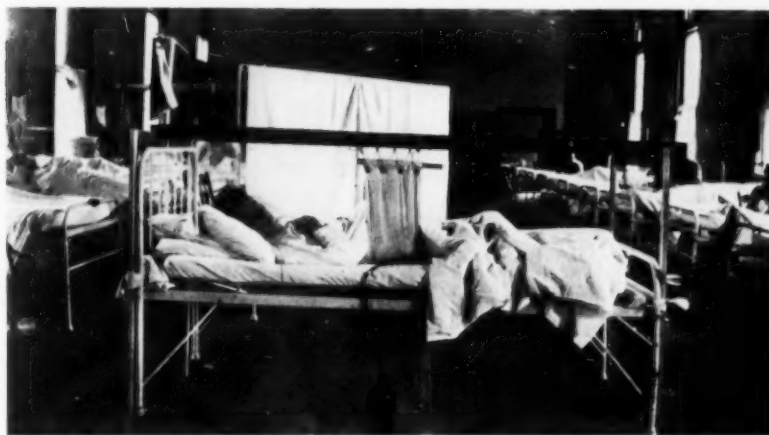


FIG. 1.—Fracture of pelvis (bilateral) with rupture of urethra and suprapubic drainage (Doctor Hodge's service). Treatment by suspension and satisfactory results from all standpoints.

tures of the pelvis. This particular patient, under Doctor Hodge's care in the Presbyterian Hospital for a fracture of the pelvis, complicated by rupture of the urethra, was a severe test of the method, and Doctor Hodge pronounced it satisfactory. Doctor Jopson had used it in several cases, including a fracture of the pelvis, with multiple lines of fracture, anterior and posterior, in a child of five years. This case, submitted to exploratory laparotomy by Doctor Speese, and later suffering from extensive sloughing of the skin and subcutaneous tissues of the back, from the fracturing force, was handled with ease by suspension in this manner, until the bones had united. All adult patients in whom it had been used voiced their satisfaction with it.

## CONGENITAL STENOSIS OF THE COLON

DR. H. P. BROWN reported a case of congenital stenosis of the colon, sigmoid and upper rectum in the person of a female infant who was admitted to the service of Doctor Jopson at the Children's Hospital, June

18, 1920. She was in fair condition when born; had one black meconium evacuation after birth.

She began to vomit on the morning of the fourth day, day of admission, and continued doing so all day. The vomitus was dark green and fecal in character.

On admission the temperature was  $100^{\circ}$ ; pulse, 150; and respiration, 42.

Examination shows a fairly well-nourished child in rather poor condition. The head and chest are apparently normal. The abdomen is somewhat distended and a little firmer than usual. There is not any palpable mass present. The rectum admits the little finger up to the first joint without detecting anything abnormal.

*Operation* (10.30 P.M. day of admission): A 3 cm. incision was made below and to the left of the umbilicus, through the rectus muscle. On opening the abdomen free fecal material was evacuated. The small intestine was considerably distended, and of a dusky red color. A small mass was palpated in the region of the lower sigmoid, but it could not be exposed. The large bowel could not be identified. A distended loop of bowel was brought into the wound, its mesentery transfixed with a glass rod, the bowel opened and evacuated, and sutured to the wound. The abdomen was drained and closed.

The child left the table in fair condition and died three hours later.

At autopsy, the peritoneal cavity was filled with fæces. The opening of the enterostomy was in the small intestine, about 24 inches from the pylorus. The small intestine was greatly distended, and showed a gangrenous perforation in the jejunum, about 1 inch in diameter, 12 inches from the pylorus. The bowel at the site of perforation had been especially distended before it ruptured. The mesenteric lymph-nodes were considerably enlarged. The cæcum was in the right iliac fossa, small and firm, and had a small appendix attached. The entire colon, including the sigmoid and rectum to within 2 cm. of the anus, was hard and firm, and cord-like in character, and approximately 0.4 cm. in diameter. The lumen would admit only a small probe, and section showed that it contained a small amount of clear jelly-like material.

Weiland,<sup>1</sup> quoting from Thremin several years ago, states that of 111,451 patients in the Vienna Foundling Hospital, there were only two cases of congenital occlusion of the intestine.

Lockwood,<sup>2</sup> in the St. Bartholomew's Hospital reports, states that in 16,030 surgical cases, 19 were for colotomy, which was fatal in 12 cases. Twice the great intestine could not be found. In one of these cases there was no post-mortem, and the other showed absence of the ascending colon.

Quoting from Sir Chas. Ball:<sup>3</sup> The hind gut is all that portion behind the communication with the yolk sac, which eventually forms the entire

<sup>1</sup> Weiland: Med. News, New York, 1896, lxviii, p. 44.

<sup>2</sup> Lockwood, C. B.: St. Bartholomew's Hosp. Reports, vol. xix, 1883.

<sup>3</sup> Ball, Sir Chas.: Rectum, Diseases and Developmental Defects, 1908.

## CONGENITAL STENOSIS OF THE COLON

large intestine and portion of the ileum. In the adult, no indication of what was formerly the mid gut normally remains, but its position is not infrequently marked by congenital malformation—Meckel's diverticulum—which is usually found in the ileum tolerably near its termination. If then the hind gut has not developed, we find the rectum and other portions of the intestine absent in whole or in part, or rudimentary, and the small intestine ending in a cul-de-sac, or having an opening at the umbilicus from persistence of the vitelline duct.

He reports a case of a child three months old with imperforate rectum and anus, extroversion of the bladder and urachus to the umbilicus, and an opening between the ureters through which faeces escaped freely, and through which the intestines prolapsed. At post-mortem the rectum, entire colon, and mesocolon and cæcum were absent. The ileum opened into the extroversion and was continued beyond the opening as a short contracted diverticulum, like a vermiform appendix, the sole remnant of the hind gut.

Dodd<sup>4</sup> reports a case in which the symptoms appeared when the child was three weeks old. It died in the twelfth week, vomiting having gradually increased and the bowel movements decreased. Autopsy showed congenital contraction of the ascending and transverse colon to the size of a lead pencil. The descending colon, sigmoid, and rectum were distended but otherwise normal in appearance, with the exception of a partial annular constriction of the sigmoid.

DR. JOHN H. JOPSON said he had seen one case of congenital stenosis of the colon which resembled to some extent that described by Doctor Brown, but in which the condition of intestinal occlusion was of even greater degree. There was a congenital atresia of the entire colon, but not of the rectum. In addition, there was a stenosis of the upper portion of the jejunum at a number of points, and a great narrowing of the lower portion of the ileum. The portion of the small intestine between these points was greatly dilated. The condition of the colon was discovered as in this case when a colostomy was attempted without avail. The condition is, of course, incompatible with life. He had recently seen a case of congenital stenosis of the sigmoid, with chronic incomplete obstruction in an infant, which when seen at the age of seven months, weighed six pounds and twelve ounces. The bowels were always constipated, and after a few weeks moved only with injections, and there was frequent vomiting after feedings. A palpable mass revealed the position of the dilated and frequently impacted colon above the pelvic brim, and the X-ray examination showed an extreme degree of stenosis of the sigmoid. Only by the most skillful care and nursing had the child been carried along to this age, and operation was suggested, but as yet has not been agreed to. It now weighs eleven pounds, and is eleven months of age. The condition of the colon shows practically no change, and the dilatation is still confined to its lower end.

<sup>4</sup> Dodd, A. H.: *Lancet*, 1892, 1, 1299.

# TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY

*Stated Meeting held October 13, 1920*

The President, DR. WILLIAM A. DOWNES, in the Chair

## DUODENAL ULCER

DR. J. P. HOGUET exhibited X-ray plates of a case which he stated there were two reasons for reporting. First, on account of the operative procedure, and second, because of the old story in connection with the use of non-absorbable sutures. The patient was a man, aged forty-seven years, who first presented himself in June, 1916, suffering from the typical set of symptoms of duodenal ulcer which had persisted for a year and a half previous to this time. Dr. Lewis Gregory Cole took roentgenographic pictures at that time which showed considerable deformity of the cap and a large post-pyloric ulcer on the upper posterior surface of the duodenum. As some trouble with gastroenterostomies in similar cases had been experienced it was decided to do a modified Polya-Reichel, that was a Polya-Reichel without a pylorotomy, with the inversion of the duodenal end and taking up the jejunum with an end-to-side anastomosis with the stomach. The patient made a remarkably easy convalescence after the operation. For a year thereafter he suffered from no symptoms. Early in 1917, however, there was a recurrence of symptoms, and in examining him at this time, and giving him the test meal, the typical symptoms of duodenal ulcer were found. The radiograph showed an ulcer at the gastroduodenal stoma. The patient was put on the Lenhartz diet and at the end of about two weeks the symptoms subsided. He then went home, and though he was a rather intractable patient and did not submit readily to the regulation of his dietary, he remained well until October, 1918, when he again came back with the same symptoms of ulcer. Although at this time he did not have an X-ray taken, the symptoms were just as typical as before. The patient also recovered from this second attack on dietary treatment in ten days or two weeks and he had remained well up to the present time. The question was whether these attacks were due to two new ulcers in the duodenum due to the Pagenstecher suture. It was difficult to answer that question.

## GASTRIC ULCER

DR. J. P. HOGUET presented a man aged fifty-three years, a porter, who was admitted to the French Hospital on September 13, 1920. When first examined, Doctor Hoguet said he felt fairly positive, on account of the



## GUNSHOT WOUND OF THE ABDOMEN

history and the loss of weight and the low blood count that the man had carcinoma. The blood count showed hæmoglobin, 35 per cent., and red blood-cells 1,920,000. He had also with the test meal a fairly high acidity and a trace of blood. No tumor was palpable. The X-ray picture showed two craters of ulcers which practically closed off the pylorus. About three days after the patient came into the hospital he had a blood transfusion after the Unger method, 500 c.c. of blood from his son as donor being given. Forty-eight hours afterward he was operated upon under gas-oxygen and an immense inflammatory mass on the lesser curvature of the stomach was found completely blocking up the pylorus, and as large as a good-sized fist. There were several enlarged glands. Doctor Huguët then did a posterior gastroenterostomy without the occlusion of the pylorus. The man made an easy convalescence and in ten days was taking a pretty generous diet. On October 5th the blood count showed hæmoglobin, 50 per cent., and red blood-cells 3,200,000. The gland removed was typically inflammatory. Doctor Steiner said these two ulcers had undoubtedly perforated some time previously and had formed this mass of scar tissue.

## OLD UNREDUCED BACKWARD DISLOCATION OF THE ELBOW

DR. L. W. HOTCHKISS showed X-ray plates of an elbow dislocation of five months' standing when the patient came under his observation, so that closed reduction was impossible and he had to resort to open arthrotomy. The elbow-joint was opened by the Kocher incision on the radial side of the joint, and by extending the incision backward and along the triceps tendon on the radial side a good exposure was made. The head of the radius was first freed and then the ulnar side was approached. The adhesions and interposed capsule made the freeing of the joint very difficult. But a perfect reduction was finally accomplished without sacrificing the lateral ligaments and without damage to the musculospiral or ulnar nerves. The elbow was put up in flexion, about 100 degrees, and the plaster case was kept on for about two weeks to allow wound healing. About the third week baking, massage, and passive motion were begun and are being continued. The function of the joint is constantly improving and the patient is able to put the hand to the head. This was a typical backward dislocation of both bones of the forearm without fracture and, in the unreduced state of extension, the arm was quite useless.

## GUNSHOT WOUND OF THE ABDOMEN

DR. A. S. VOSBURGH presented a boy aged sixteen years who was shot in the abdomen at 4.00 P.M., August 29th, as the result of three boys playing with an "unloaded pistol." The boy was brought to the United Hospital of Rye and Portchester in an automobile. The patient had vomited once since the accident; 1000 units of antitetanus serum were administered. Physical examination showed a well-nourished boy, rather small for his

age, apparently in good condition—his expression was interested rather than anxious as the result of pain. The abdomen was flat. A bullet wound was seen on the right side 3 inches to right and at same level as the umbilicus; there was slight rigidity about this area. The bullet could be felt posteriorly and below the iliac crest; its position indicated that it had travelled posteriorly and slightly downward. There was no evidence of hemorrhage, shock or peritoneal irritation other than the slight rigidity about the wound of entrance. The patient complained of numbness in the anterior surface of the right thigh and it hurt him to extend the thigh; while in bed, he kept it slightly flexed. No paralysis of any muscle or group of muscles was evident. Anæsthesia was demonstrated along course of middle cutaneous branch of anterior crural.

*Operation* (8.15 P.M.).—The wound of entrance was circumscribed and the abdomen entered through a transverse skin incision and an intermuscular incision with Weir extension to gain sufficient room. A wound of the ascending colon was seen; no escape of contents was noted. The edges of the wound were inverted with purse-string suture of catgut reinforced by second, superimposed sutures. The surrounding region was explored; no other wound was found. The ascending colon was mobilized by an incision along its outer border and the posterior surface of bowel explored by rolling it toward the median line. In the loose areola retroperitoneal tissue no wound of exit could be located. The tract of bullet could be felt through the substance of the psoas-iliacus. A counter opening was made through the flank to drain this retroperitoneal region. A bullet 38 c. extracted through a third incision from the substance of the gluteus maximus; a few splinters of the ilium could be felt in this wound. Rubber dam cigarette drains were led to site of anterior perforation, to the retrocæcal region, and to the region where the bullet had lodged.

The abdominal drain was removed August 31st; retrocæcal drain was removed September 2nd, while the drain to wound in buttock was not removed until September 5th. The patient was discharged September 15, 1920, when all wounds were healed except the granulating tracts at the sites of drains.

DOCTOR HOGUET spoke of two cases in which he found open wounds of the ascending colon in front and could find none behind. Both of these patients did badly and died, and he felt that there was a wound behind that he had not been able to locate. In these two cases he thought there was a retroperitoneal cellulitis. It was pretty difficult to find these wounds in the posterior surface of the ascending colon. In view of this difficulty he wondered if the proper procedure was not to drain posteriorly as well as anteriorly, as Doctor Vosburgh had done.

DOCTOR VOSBURGH seconded what Doctor Hoguet had said about looking for a posterior opening in the ascending colon. If he had to do such an operation again he would drop a probe through the anterior opening

## OBSERVATIONS IN CHOLELITHIASIS

and follow up the direction of the wound to where one would expect to find a posterior opening. In this case as soon as he closed the anterior perforation he closed the peritoneum except at the site of drainage. The ascending colon was then mobilized and rolled toward the median line and one came to the areolar space where if there was much blood it was very difficult to recognize an injury, and one was unable to find a posterior hole because of the infiltration. So he thought it well to leave in a good-sized drain posteriorly. The abdominal wound was closed except at the drain, and it was closed tightly around the drain. The posterior drain emerged just above the crest of the ilium in the loin.

## CHOLECYSTECTOMY FOR CHOLELITHIASIS

DOCTOR VOSBURGH presented two women in each of whom the gall-bladder had been removed for the relief of symptoms due to cholelithiasis.

## OBSERVATIONS IN CHOLELITHIASIS

DOCTOR GEORGE WOOLSEY read a paper with the above title, for which see page 46.

DR. ROBERT T. MORRIS said it seemed to him the question of closure with or without drainage was one of histology rather than of pathology. If one ligated the appendix it remained ligated because it was a disappearing appendage. If one ligated the oviduct, on the other hand, it was almost always a failure because nature found a way for opening the lumen, being interested in the preservation of its function. Nature was on the fence in regard to the value of the cystic duct; sometimes it remained closed after ligation, and sometimes it opened. All three of these structures were much alike in diameter and general structure, but all three acted differently under ligature for reasons histologic and biogenetic.

As to the X-ray, we were told by the neurologists that if we wished to live long we must not worry. One need not worry about diagnosis if the X-ray showed no gall-stones; it was only necessary to tell the patient that he required an operation for cholecystitis, and then if one found stones it was all velvet. The biggest thing that ever got into the gall-bladder was the microbe, and there was no reason why we should not have recurrences such as Doctor Woolsey had shown so long as an original focus of infection was present.

The question of that class of patients in which pancreatitis was found was one of great consequence. Doctor Deaver had called attention to an acute lymphatic infection, but a chronic interstitial pancreatitis was more frequent than lymphatic infection. Sixty to 70 per cent. of all cholecystitis cases might be found to include chronic interstitial pancreatitis; that was commonly overlooked.

DR. JOHN DOUGLAS said he had some doubt as to the assumption upon which Doctor Woolsey based the conclusions that cholecystectomy was the operation of choice as the cure for chronic pancreatitis. In the first

place, Doctor Woolsey assumed the correctness of Doctor Deaver's conclusions as to the infective origin of pancreatitis through the lymphatics. Personally he could not see how an infection starting in the gall-bladder passed through the groups of lymphatic glands along the cystic and common ducts, about the pylorus and the head of the pancreas into the pancreas itself to cause a chronic inflammation, always travelling against the normal lymph stream. Such a thing did not happen elsewhere in the body. It seemed to him that the assumption of Archibald that an infection of the gall-bladder caused the change in the bile, increasing or changing its bile salt and bile acid content, and that this was responsible for the pancreatitis by reflux into the pancreatic duct rather than by lymphatic infection was a more plausible theory. He thought one would have to acknowledge a certain number of cases might be caused by the duodenal content entering the pancreatic duct, particularly when the larger of the two pancreatic ducts did not empty together with the common bile duct through the papilla of Vater. He would like to know whether in the cases of chronic pancreatitis the bile duct was drained by Doctor Woolsey and whether Doctor Woolsey considered the removal of the gall-bladder responsible for the cure of the pancreatitis. Doctor Deaver always drained and advocated prolonged drainage of the bile duct in cases of pancreatitis. Balfour has recommended the removal of the gall-bladder for the cure of chronic pancreatitis, but this was because there was a resulting dilation of the common duct and the loss of power in the sphincter of Oddie. Doctor Douglas said that this was certainly not always effectual, as he could recall one case in which he had performed a cholecystectomy for cholelithiasis and the patient died two years later as a result of an acute pancreatic necrosis.

DR. T. LE WALD called attention to the statement that "the visualization of gall-stones depends on the percentage of calcium in the stones and on the density of the enveloping bile. His own figures do not compare favorably with the larger percentages, notwithstanding that abundant material has been at his disposal. Many of the cases gave typical histories, but even in these, although extraordinary efforts were made, it was possible to find diagnostic shadows in only a small minority. The difficulty has been, not to find shadows, for these were often present, but to find shadows that are definite and characteristic." Nevertheless, Doctor Le Wald said he felt it might be well to look for stones, for in the search one might find just the information that would turn the tide of diagnosis. In fact, this had often proved to be true, though he could not say in what percentage of cases. He thought the best way to do was as they were doing at St. Luke's Hospital. Before giving the opaque meal the gall-bladder region of the patient was especially examined, and in a very small percentage of cases stones were found which were calcified. There were borderline cases in which a ring shadow might reward one's efforts and make him sure of his diagnosis. On the other hand, there

## OBSERVATIONS IN CHOLELITHIASIS

were cases in which no amount of effort could ever show the type of gall-stone which was just equal in density to the surrounding bile or gall-bladder wall. Doctor Le Wald had demonstrated this by taking the freshly removed gall-bladder and placing it upon the X-ray plate and radiographing it in hundreds of instances.

DR. FRANK S. MATHEWS called attention to the fact that cases with a mild chronic cholecystitis often gave definite, intermittent attacks of pain strongly simulating biliary stone. He made the diagnosis of chronic cholecystitis on adhesions, change in color of the gall-bladder, moderate contraction of the gall-bladder, and viscid black bile. The latter was by no means constant and would seem to indicate that the attacks of pain were not necessarily related to inability of the gall-bladder to empty itself. The microscope in these cases might show but very moderate departures from the normal. If such gall-bladders—definitely the seat of chronic cholecystitis—could give attacks of pain without stones, it would suggest the advisability of removing the gall-bladder containing stones, even when the inflammation was not great.

As regards the use of the X-ray, he thought its greatest value was in eliminating other conditions of the gastro-intestinal tract. Certainly marked degrees of thickening and adhesions could exist without X-ray evidence. In four cases in which he had operated recently, diagnosed positively by röntgenologists as gall-stones, only one proved to have them.

DR. SETH M. MILLIKEN said mention had been made in the paper of the closing of the wound without drainage. It did not work. Doctor Morris says nature is on the side of the oviduct; she is on the side of the cystic duct, too. He confessed to one case in which everything seemed so dry that the wound was closed without drainage. Slight temperature and swelling in the wound on the sixth day indicated a small opening from which bile escaped for eight days. Recovery was otherwise uneventful.

DR. HERMANN FISCHER called attention to a group of cases in which there existed a chronic cholecystitis without the formation of stone. In these cases adhesions between gall-bladder and the neighboring organs of varying density were present. The wall of the gall-bladder was usually thickened, although one also might meet a gall-bladder that looked macroscopically almost normal. These gall-bladders must be removed in order to get the patients well; the removal of the adhesions would not be sufficient to effect a cure. All these gall-bladders which had been removed by him for this condition were carefully examined and all proved to be the seat of a chronic inflammatory condition.

The necessity of drainage was very much impressed upon his mind by two cases of cystic stump leakage in which no drainage was employed by the surgeon who had operated upon them. Both patients subsequently had to be reoperated upon but succumbed to the peritonitis



caused by the escaping bile. The question of primary closure after cholecystectomy had been discussed quite freely of late and he was aware that some surgeons advocated it. He himself, however, advised strongly against it.

X-ray pictures in some cases might confirm the diagnosis of biliary calculi, although even with positive findings, one might be misled. Doctor Fischer cited a case of obstruction of the common duct in which he suspected malignancy. The X-ray showed a shadow that was interpreted as being a stone in the common duct. Operation revealed a carcinoma of the common duct, with a calcified lymph-node at the angle of common duct and duodenum.

DOCTOR WOOLSEY, in closing the discussion, said that perhaps he had inadvertently given his view of Doctor Deaver's opinion rather hastily. When he spoke about pancreatitis he did not mean lymphatic pancreatitis but indurated interstitial pancreatitis. About 33 per cent. of the cases reported had that variety of pancreatitis. A certain number of these cases caused pressure on the common duct and this produced jaundice. Whether Doctor Deaver's view of infection through the lymphatics was correct he did not know. This chronic interstitial pancreatitis was quite different from acute pancreatitis. He had removed the gall-bladder in all cases of pancreatitis, but he had not drained the common duct in all these cases. If there was jaundice he drained the common duct. He agreed with Doctor Fischer and Doctor Mathews with regard to cholecystitis and the advisability of removing the gall-bladder in that condition, but he had not stressed that as his paper was on cholelithiasis and not on cholecystitis.

#### LARGE OVARIAN CYST IN INFANT OF SEVEN MONTHS

DR. WILLIAM A. DOWNES presented a specimen, which was removed from an infant, aged seven months. The child was admitted to the Babies' Hospital, September 24, 1920. The infant was full term; weighed 9½ pounds; delivery was normal. A smooth, symmetrical swelling was noticed in the lower part of the abdomen immediately after delivery, gradually increasing up to the present time. The condition was thought at first to be Hirschsprung's disease. The child's general health had continued good. It ate and slept normally. The bowels were regular. Examination at this time showed a well-developed and well-nourished infant with an enormously distended abdomen, showing the usual signs of encysted fluid. The length of the baby was 25 inches and the circumference of the abdomen 24 inches. Weight, 17 lbs. 2 oz. The ante-operative diagnosis was possible ovarian cyst. At operation on September 24, 1920, a lower right rectus incision disclosed a single ovarian cyst containing 2½ litres of fluid. The pedicle was tied off with No. 1 plain catgut. The abdomen was closed in the usual way. The child was discharged from the hospital October 7, 1920. Bland Sutton reported sixty



## DIVERTICULA OF JEJUNUM

cases of tumor of the ovary in children under fifteen years of age. In this group the youngest case occurred in a child one year and eight months old. The earliest time a swelling was noticed in any case of this series was four weeks after birth. In the case herewith reported the swelling was noticed at the time of birth.

### DIVERTICULA OF THE JEJUNUM

DR. CLARENCE A. McWILLIAMS presented a specimen obtained from an elderly gentleman aged seventy-one years, who in January, 1917, was

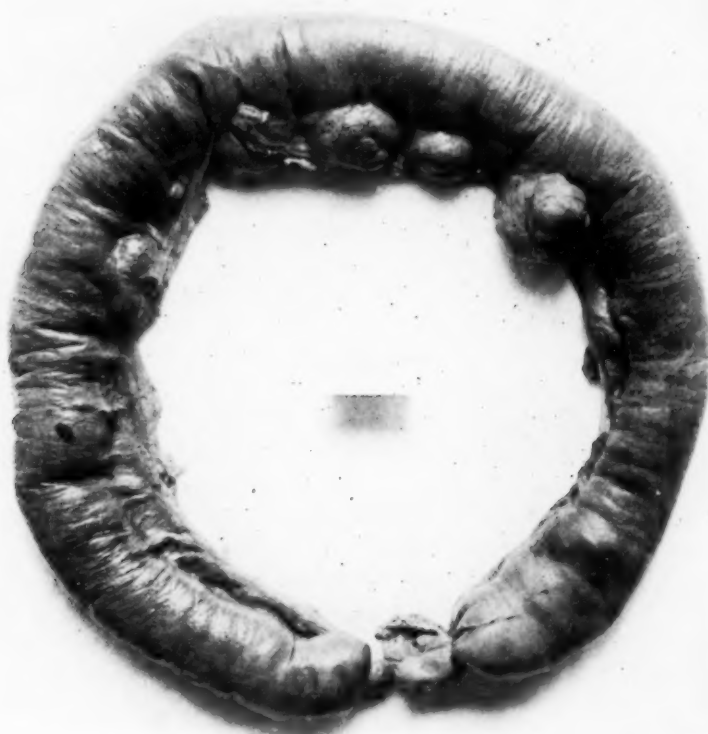


FIG. 1.—Diverticula limited to the upper three feet of jejunum.

a private patient in Presbyterian Hospital, suffering from hypertension and general arteriosclerosis. He again came into the Presbyterian Hospital as a private patient on September 8, 1920, with very acute abdominal symptoms which began twenty-four hours previously; there was exquisite pain uncontrolled by large doses of morphine, and vomiting at the onset and during the next day, accompanied by two loose, blood-free stools in the beginning, but none since. There were marked distention and tenderness of the mid-abdomen with flattening in the flanks, but without ascites or any palpable mass. Rectal examination was negative. The pulse was small, thready, very rapid and irregular. The tempera-

ture was normal. A diagnosis was made of intestinal obstruction, probably dependent upon mesenteric thrombosis. This etiology was preferred because of the hyperacuteness of the onset with vomiting, diarrhoea, colossal pain associated with mid-abdominal distention and tenderness, and a history of cardiac difficulty. Immediate operation was impossible because of the wretched pulse. Intravenous digifolin was given twice, also a high turpentine enema. No response was obtained from either. The man died within five hours without operation.

At the autopsy (Doctor Von Glahn) the small intestine was found distended and for the most part dark red in color with here and there a greenish discoloration to some of the loops. The jejunum showed the maximum amount of distention and discoloration. Along the mesenteric attachment of the jejunum there were seven large diverticula (Fig. 1), the largest of which measures 4 cm. in its greatest diameter. Some of these diverticula have numerous small bosses projecting from their surfaces. None of these diverticula were adherent to any surrounding structure, showing an absence of peridiverticulitis. The entire small intestine contained a large quantity of thick, bloody fluid. The mucosa had a very hemorrhagic appearance and there appears to be some hemorrhage in the submucosa. The large intestine was collapsed, which is difficult to explain in view of the complete inferior mesenteric thrombosis, and was free of diverticula. The stomach contained, besides gas, a considerable quantity of dark, stercoraceous, foul-smelling fluid.

In the transverse portion of the aorta there are numerous yellow plaques, many with ulcerated centres. In the abdominal aorta there are two aneurisms, one just above the coeliac axis and the second above the bifurcation, in each of which there are clots. In the superior mesenteric artery there was a clot which entirely occluded the vessel, beginning just above its first branch and running down into all of its main branches for a short distance. The orifice of the inferior mesenteric artery was entirely occluded by a clot in the aneurism just above the bifurcation of the aorta, and this vessel was entirely occluded by a thrombosis which extended down into it for 2 cm.

Diverticula in the upper small intestine alone without similar lesions in the large intestine, must be very rare, for there are but few reports of such occurrences, either met with at operation or on autopsy. It will be noticed that all these diverticula were at the mesenteric border, presumably resulting from a herniation along the vessels. I have seen no report of diverticulitis or peridiverticulitis of the small intestine, excepting that of Meckel's diverticulum.

## BOOK REVIEWS

DIAGNOSIS AND TREATMENT OF BRAIN INJURIES WITH AND WITHOUT A FRACTURE OF THE SKULL. By WILLIAM SHARPE, M.D. J. B. Lippincott Company, Philadelphia. Octavo, cloth, pp. 757.

Brain surgery to-day is well advanced beyond the embryonic stage of development, and even though many problems are yet unsolved, the work of Harvey Cushing, and his associates, has established certain definite principles in operation to-day wherever the most modern standards of technic are employed.

While not entirely so, much of the brain work neglected to-day is owing to late diagnosis, when the victims of various lesions have passed their opportunities for maximum relief and when only temporary abatement of symptoms is attainable. However, with the immense amount of material of this nature needlessly ignored it still remains a matter of authentic record that the great strides of the last ten or fifteen years have placed the possibilities of this work in the lists of truly essential surgery.

Since many of the earlier restraints here encountered due to fear of death during operation, infection, etc., have been repudiated by experience, it remains to build up the weakest spot—diagnosis—so that the patient may derive the earliest and fullest recovery in each individual instance. Here lies the weakest link in brain surgery to-day, and through this casts a shadow over the entire domain, out of all proportion to the risks of operation.

But when patients continue to be neglected until tumors produce high-grade, choked disks or beginning atrophy, and in some cases paralyses, and acute traumatic cases are carried along until irreparable intracranial pressure damage is committed, the responsibility is to be found farther back than the patient's skull.

The volume under review is particularly valuable because it represents in its large amount of clinical material all types and all stages of brain lesions, both acute and chronic. Errors are frankly revealed, so that they may in future be understood before they occur, hence more readily avoided by the enlightened interpretation of experience.

Great stress is given the acute brain injuries, and particularly those associated with skull fractures, and demonstrating high grades of intracranial pressure which is given a place of first importance and justly so. This same principle of pressure within the skull is emphasized as basic in relation to tumors and other lesions constantly producing destructive effects on the intracranial contents.

The operation for purely decompressive effect, the subtemporal decompression, is given in great detail, with numerous illustrations and careful explanation of the purpose of each step in this procedure, together with a description of the special instruments used.

## BOOK REVIEWS

The last section of the book comprises an extensive treatise on acute and chronic injuries of the brain in the new-born and in children, particularly stressing those lesions of hemorrhage and its residual effects in this class of patients, urging earliest recognition for complete recovery and describing the possibilities of relief where some damage has already taken place.

This volume has much to offer, and stimulates much thought, and its usefulness is by no means restricted to the medical man engaged in the specialty of brain surgery.

HORACE G. DUNHAM.

*SURGERY OF THE SPINE AND SPINAL CORD.* By CHARLES H. FRAZIER, M.D.

With the rapid advances in surgery, both general and special, it has become constantly more evident that the monograph fills an important niche in medical literature, and nowhere is this more definitely exemplified than in the highly specialized branches of surgery pertaining to the central nerve system.

The past decade particularly has witnessed so many forward strides in brain and spinal cord surgery alone, that to much more than refer to them in any work on general surgery is wholly impossible. Furthermore, such material in a general work on surgery is more often designed to meet the needs of the undergraduate medical student than the man in actual practice, and for this very patent reason the work devoted exclusively to a specialized region always fills a real need for others working or interested along parallel lines of endeavor.

The work under consideration is not only complete, but exhaustive when including the elaborate bibliography for further reference and cites a vast amount of material within its pages both from the author's clinics and from those of others working in this field. One might truly call it an encyclopædia on the spine and its contents, taking up, as it does, the anatomy, physiology, pathology, and röntgenology in the same volume which discusses the practical treatment of the various lesions described.

A distinctive feature of this monograph well stated in the author's introduction, is the facility offered the reader by having all data referable to his subject in one volume, thereby obviating the frequent and often tiring process of many different books for reference on one point.

The large number of illustrations are so clear and well adapted to the corresponding text as to prove additional features of much value in practice.

The section on lumbar puncture is especially timely as it deals fully not only with the technic of introducing a needle into the spinal canal, but also with those measures of a therapeutic nature related to this procedure such as introduction of sera for tetanus and meningitis, also the treatment for syphilis of the cord as well as the method of spinal anæsthesia.

Acute and chronic lesions of all types known to affect the spinal column or its contained cord and membranes, are described and the most advanced methods of dealing with them are explained.

HORACE G. DUNHAM.

## BOOK REVIEWS

**SURGERY.** A Text-book by Various Authors, edited by GEORGE C. GASK and HAROLD W. WILSON. London, J. and A. Churchill. Philadelphia, Blakiston's Son & Co. Cloth, Octavo, pp. 1232.

This somewhat bulky volume does not attempt to present the whole of surgery but to deal with its practice rather than its theory, so that the principles of surgery, the history and statistics of surgery, surgical anatomy and surgical pathology, and much of clinical surgery and operative details, are omitted.

On the other hand, rather unusual in the surgical treatises of the present day, sections devoted to such specialties as the eye and ear are included. Especial interest attaches to this volume because it is made up wholly of contributions from the staff of a single English hospital, St. Bartholomews, of London. The editors in their preface state that the services of every member of the general surgical staff were secured in the compilation of the work while from specimens in the museum of the same hospital were made many of the drawings which illustrate the book.

It is as a hand-book or text-book, which presents in a general way the ideas and methods that govern the surgical practice of one of the most prominent and oldest of the London hospitals, that attention will be attracted to this book. Naturally the amount of space given to various departments will not satisfy the judgment nor the needs of everyone who may consult it. Nor in these days of monographs and elaborate studies, and of rapidly developing knowledge and subsequent changes of practice, will any surgeon who desires to keep himself up to the present-day possibilities of his work, feel that he can do without the many volumed systems and the many important monographs which are appearing at such short intervals.

The practitioner, however, who desires to have in one volume, a record of the views and practice that control to-day, the work of a great metropolitan hospital, will be glad to have this book.

LEWIS S. PILCHER.

**A TREATISE ON ORTHOPÆDIC SURGERY.** By ROYAL WHITMAN, M.D., M.R.C.S., England; F.A.C.S.; Associate Surgeon to the Hospital for Ruptured and Crippled in New York; Chairman of the Medical Advisory Board for Orthopædics in New York City. Sixth Edition, 914 pp., 767 illustrations. Philadelphia and New York: Lea and Febiger. 1919.

The arrangement of the sixth edition of Whitman's excellent text-book on orthopædic surgery is the same as in the previous editions. The headings of the first twenty-three chapters are also the same, although there are many additional sections to these chapters. The book is profusely illustrated and is evidently planned as a text-book for undergraduate students. As such it fulfils its purpose admirably, especially in relation to the fundamentals of orthopædic surgery.

## BOOK REVIEWS

There is a new chapter of fifty-four pages on military orthopædic surgery. This additional chapter is suggestive rather than exhaustive, illustrating some of the standard splints adopted by the United States Army and certain of the newer methods of treating fractures and joint lesions. There are also sections of the chapter dealing with artificial limbs, the preparation of the stump, nerve injuries, and tendon transplantations for irreparable nerve injuries and traumatic conditions. It furnishes an interesting commentary of the broadening scope of the specialty and indicates that we must soon derive the word orthopædic from *ὀρθός*, "straight" and the verb *παιδεύω*, "to educate," rather than from its roots, *παῖς* "a child," since training in the correction of deformity and the restoration of function in the lesions of the extremities and spine in adults has become quite as important a part of the education of an orthopædic surgeon as familiarity with the congenital and acquired deformities and bone lesions of childhood. We might well wish that the consideration of adult lesions had been still more full and that the operative procedures had been described and illustrated in more detail. The text-book nature of the work excuses this inadequate presentation and perhaps entirely justifies it, since the present amount of time allocated to orthopædic surgery in even our best medical schools is entirely insufficient for thorough training in the treatment of these adult conditions.

Whitman's orthopædic surgery is perhaps the best American text-book on the subject. It should be read carefully and often, not only by medical students, but by all graduates who enter the specialty. The style is clear and readable, the descriptive pathology is simple and yet sufficiently detailed to furnish basic conceptions of the nature of the morbid processes. The differential diagnosis is quite exhaustive and helpful. Although the methods of treatment outlined often include those advised by different authorities on the subjects under consideration, the author succeeds in impressing the reader with his own wide experience and the success of the many practical methods which he himself has originated. The excellent end-results which he has obtained by the practice of these methods are the criteria by which their value may be judged.

ROBERT B. OSGOOD.

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